1985

EVALUATION OF SALINITY CONTROL PROGRAMS

IN THE COLORADO RIVER BASIN

1985 JOINT EVALUATION OF SALINITY CONTROL PROGRAMS IN THE COLORADO RIVER BASIN

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Prepared by

Colorado River Water Quality Office
Bureau of Reclamation

and the
USDA Salinity Control Coordinating Committee
U. S. Department of Agriculture

in Cooperation With

Bureau of Land Management,
Geological Survey, Fish and Wildlife Service,
and the Environmental Protection Agency

FOREWORD

This report is a combined DOI-USDA effort which consolidates two different reports. The DOI report is the Bureau of Reclamation 1985 Evaluation Report required by the Commissioner of Reclamation as a management document used in the (MBO) Management By Objectives approach to program management. The USDA report is the Annual Report on the Colorado River Salinity Control Program, published as a separate document in prior years. This combined report reflects upon the efforts by DOI and USDA to more fully coordinate and integrate the respective salinity control programs authorized in P. L. 98-569, amendments to the Colorado River Basin Salinity Control Act of 1974 (P. L. 93-320).

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219), the decree entered by the Supreme Court of the United States in Arizona vs. California, et al. (376 U.S. 340), the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S. Code 618a), the Colorado River Storage Project Act (70 Stat. 105; 43 U.S. Code 620), or the Colorado River Basin Project Act (82 Stat. 885; 43 U.S. Code 1501).

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FINDINGS AND RECOMMENDATIONS

The findings and recommendations that are briefly summarized here are the result of a joint evaluation process conducted by the Department of the Interior and the Department of Agriculture. The findings are presented as a program management tool to accomplish salinity control objectives at minimum cost. This approach to long-term, program-wide analysis is helpful to Federal program managers when weighing the many budget choices each year.

The 1985 Evaluation Report was prepared using data adjusted to more accurately compare the program information of the two departments. All costs (October 1984) and interest rates (8 3/4 percent) have been adjusted to the same base.

The base case condition for the CRSS model evaluation assumes no funds expended on salinity control beyond those already spent on Grand Valley, Meeker Dome, Uinta Basin, and Las Vegas Wash. These projects, or portions thereof, have already removed approximately 115,600 tons of salt annually from the river system. As measured against the base case, projections of future salinity used an historical hydrology (1906-1983) data base in 15 sequences and the Bureau of Reclamation depletion projections (similar to the Forum's high depletion level).

The TDS at Imperial Dam is projected to reach about 1005 mg/L by the year 2010. Using the salinity projections at Imperial Dam, salt load reductions required to reduce projected TDS levels to the numeric criteria level of 879 mg/L were estimated and are referred to as the "target." Because of hydrologic fluctuations in the Colorado River Basin, the target salt load reduction would be met about 50 percent of the time in the future.

The budget constraints computer model developed by Reclamation and Colorado State University was used to evaluate different project investment levels. This model determines the optimal combination of projects and construction timing to meet salt load reduction goals at minimum investment levels. The annual and cumulative construction costs were constrained by $10 million increments for a total of $50 million annually and a total cumulative investment level--$301 million, $570 million, etc.

Project cost effectiveness ($/ton) was not the determining factor in the analysis by the model and, while it is important in selecting the projects to implement (as directed in Public Law 98-569), it is not the only consideration in the

development of an implementation schedule. Aside from the basic technical risks involved, the basinwide program must also address the uncertainties of implementation in the social, political, institutional, and legal arenas. Local concerns and needs, management of the total irrigation system, and other regional impacts are involved in the final selection of an implementation plan.

After project mixes were selected by the budget constraints computer model, a review of future implementation scenarios compared different investment level programs to the required salt load reduction (target) and to the repayment capacity of the Lower Basin Development funds.

Annual review and revisions are required to improve data, refine the analysis, and to confirm the validity that a lessor investment level (approximately $570 million) will satisfy the program goals. However, the 1985 evalution does indicate that any delays in current program implementation will result in a much more costly overall program. Long lead times for project implementation and construction costs continue to increase over time. To avoid later deficit funding in the Lower Basin Development fund, we must continue program planning and implementation schedules at current funding levels and not delay construction because high flows for the past three years have lowered the salinity level in the system.

Major Findings

1. Continued close coordination between USDA and Interior implementation programs is essential for overall, effective program direction and management.

2. To keep the project implementation schedule on track, the evaluation will need to be accomplished annually for the next few years to allow for inclusion of newly formulated, more cost effective projects and changes in technology, basin depletions, interest rates, etc.

3. Breaking large units into smaller increments appears to have advantages by allowing more flexibility in selecting project mixes, resulting in an overall more cost-effective program.

4. Total construction costs for the program to meet the numeric criteria and target load reduction is now projected to be about $570 million (1984 price level), significantly less than previous estimates ($1.9 billion in 1983).

5. While the projects already authorized or completed (Fixed Starts - $301 million level) will meet salinity reduction requirements for the next 10 years, in order to meet the program needs beyond the next decade, ongoing construction activities must be continued and scheduled construction of new projects initiated some time in the next 5 years due to the long project implementatation lead times. The $570 million investment level appears to best satisfy the remaining long-term target reduction requirements at least investment cost.

6. An investment level of $570 million provides for minimum Federal, State, and local costs within a reasonable time frame. Increased investment costs up to $703 million will reduce the risk of not meeting the target requirement but at much greater cost. Midcourse corrections in program management and project selection will allow an improved matchup of program accomplishment and future requirements.

7. The Lower Colorado River Basin Fund can repay its share of the total program costs for the $570 million investment level as projected in figure 1. Funds available exceed annual payouts during the entire period. Adequate funds are also available with the assumption of inflation rates up to 4½ percent per year for the repayment period ending in 2010.

Management Recommendations

1. General guidelines for program direction:

   a. Reanalyze fixed project starts for possible schedule modifications to allow more cost-effective projects to be started earlier.

   b. DOI and USDA should support the $570 million investment level for program planning and budgeting purposes.

   c. Continue program evaluation annually to improve on investment, repayment, and risk analysis.

2. Continue to emphasize interagency coordination:

   a. Support direct USDA-Reclamation effort by keeping USDA Basin Coordinator in Reclamation's Colorado River Water Quality Office.

   b. Continue technical coordination and policy committees.

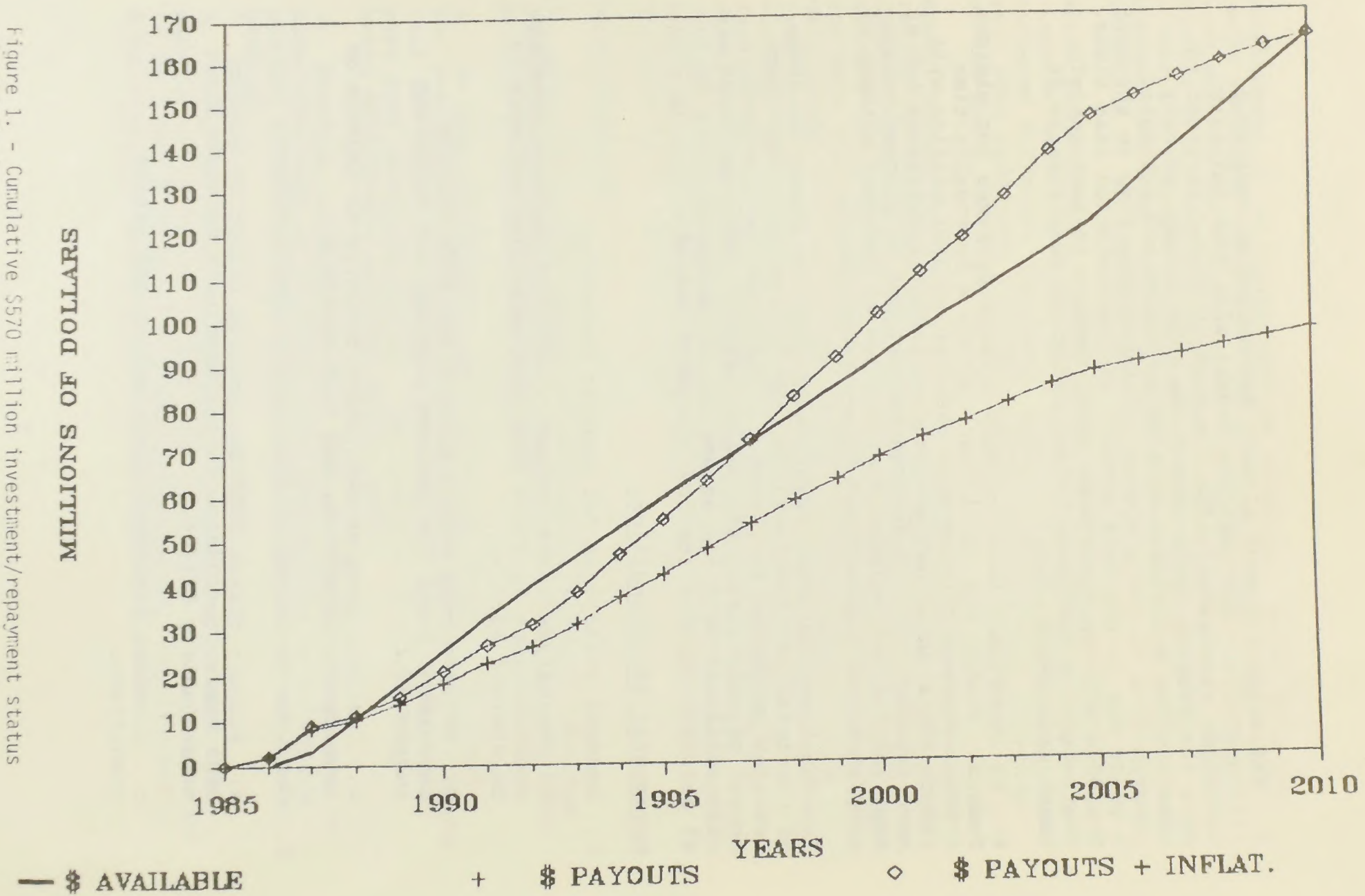


Figure 1. - Cumulative $570 million investment/repayment status of LCRB Fund.

INTRODUCTION

This interagency report provides the basis for continuing evaluation of the Title II portion of salinity control programs in the Colorado River Basin. It is intended to serve as a comprehensive financial/management level analysis of all Federal and State efforts in the basin. This annual evaluation is provided as a management tool to ensure that the program is being carried out in the most cost-effective manner in accordance with legislative requirements and current program schedules. The Title I part of the salinity control program downstream from Imperial Dam is summarized for information purposes in this report.

Colorado River Basin

The Colorado River Basin encompasses portions of seven states. The river flows over 1,400 miles from its headwaters in Wyoming and Colorado. It joins with tributaries from Utah and New Mexico, flows through the Grand Canyon, provides state boundaries for Nevada, Arizona, and California, flows through the Republic of Mexico, and terminates in the Gulf of California.

The Colorado River provides municipal and industrial water supplies for over 18 million people and irrigation water to over 1,000,000 acres. The river, however, carries about 9 million tons of salt annually past Hoover Dam. Projections indicate salinity levels increasing beyond numeric standards if controls are not implemented, even though recent high flows have flushed and filled the major reservoirs. The result was significantly lower salinity levels at Imperial Dam--from an annual average of 826 mg/L in 1982, to 710 mg/L in 1983, and 670 mg/L (provisional) in 1984.

Colorado River Water Quality Improvement Program

The CRWQIP (Colorado River Water Quality Improvement Program) was initiated as a general investigation program by Reclamation (Bureau of Reclamation) in 1971. See figures 2 and 3. The general goals and objectives governing salinity control in the basin have been established by two key pieces of Federal legislation: The Federal Water Pollution Control Act, as amended, Public Law 92-500, currrently known as the Clean Water Act, and the Colorado River Basin Salinity Control Act of 1974 as amended, Public Law 93-320.

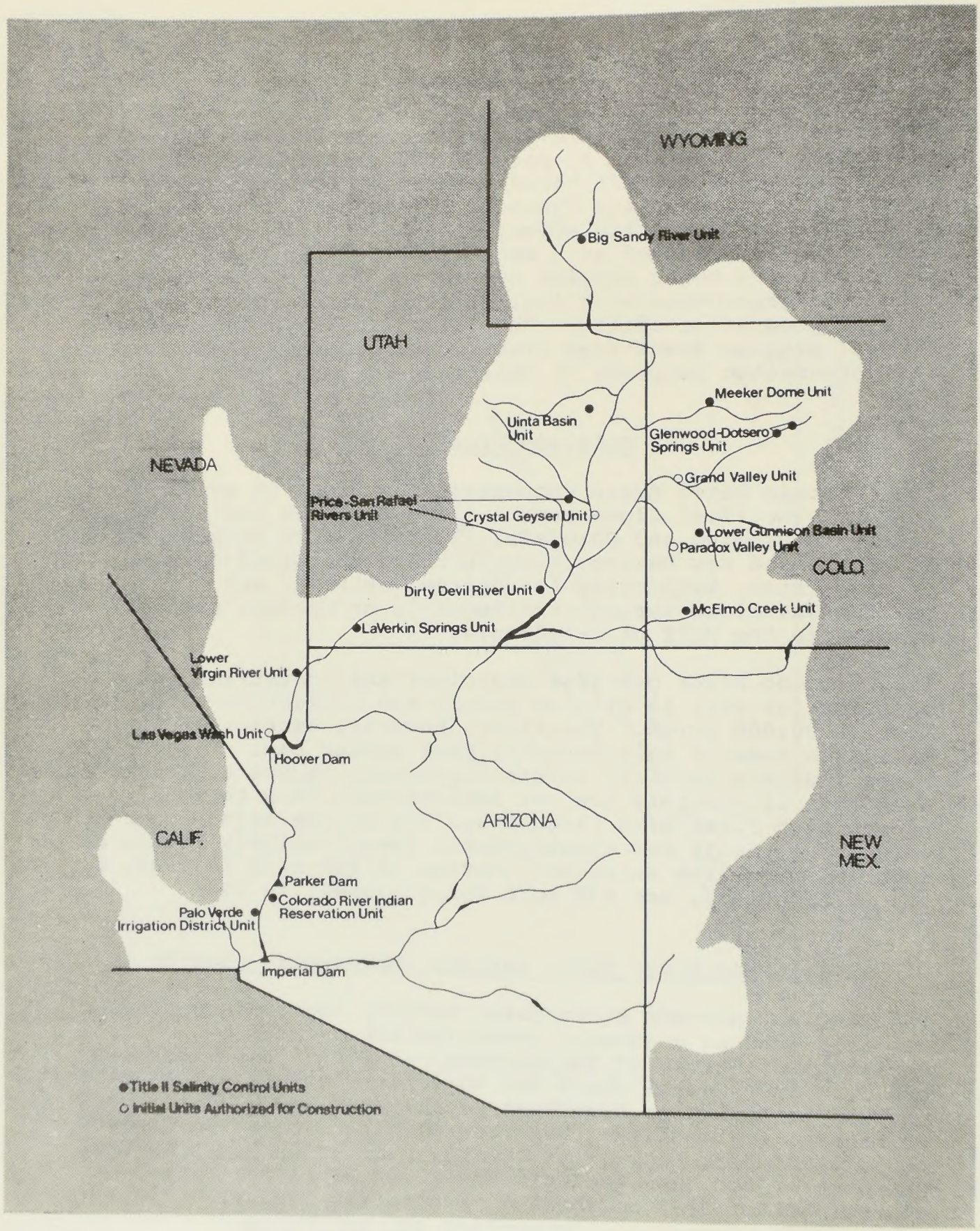


Figure 2. - Bureau of Reclamation units.

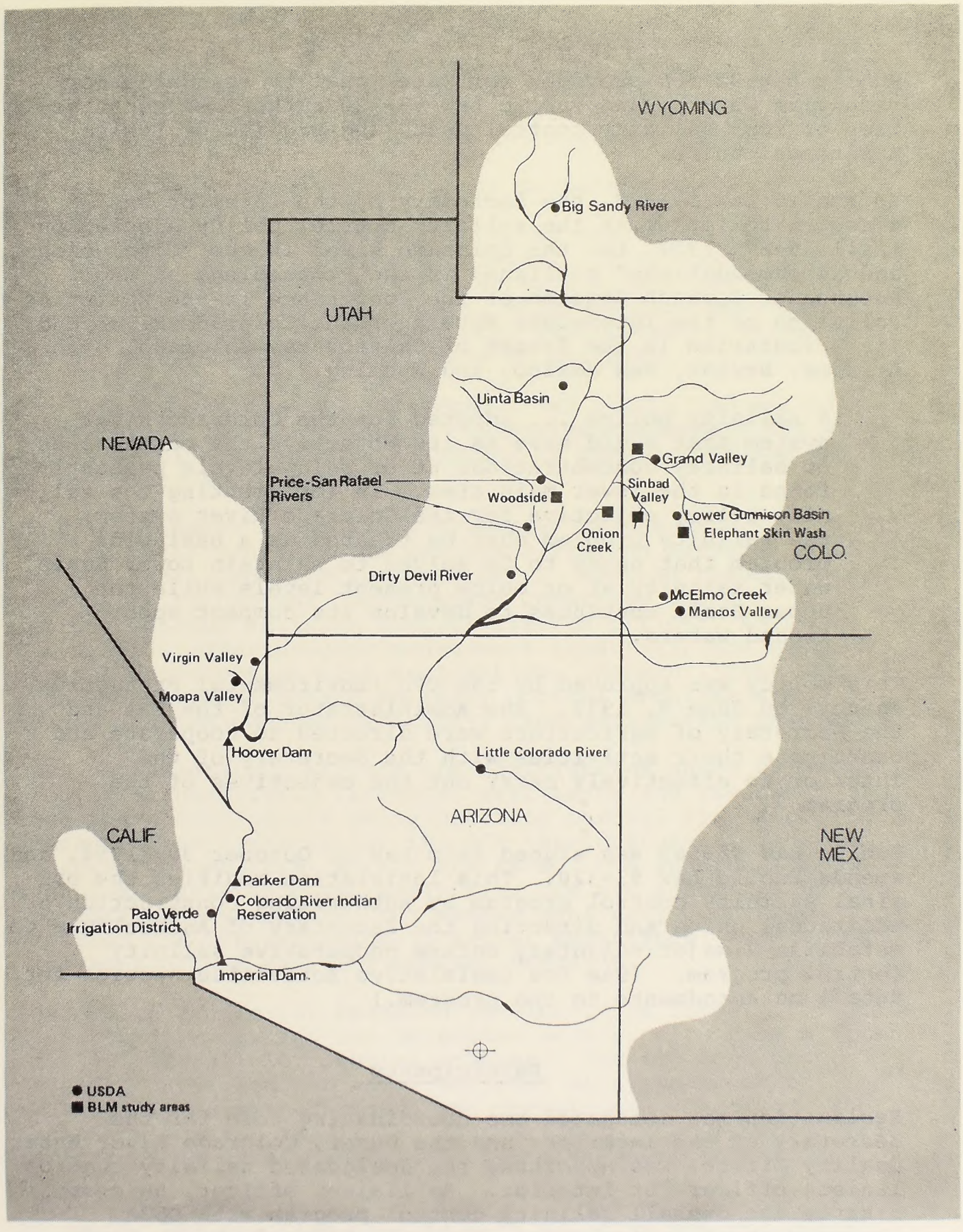


Figure 3. - Department of Agriculture and Bureau of Land Management projects.

Public Law 92-500 provides for water quality standards for receiving waters, and Public Law 93-320 authorized construction of four salinity control units and studies of twelve additional units.

In Public Law 93-320, the Secretary of the Interior was directed to implement the salinity control policy adopted on April 26-27, 1972, for the Colorado River in the "Conclusions and Recommendations" published in the Proceedings of the Reconvened Seventh Session of the Conference in the Matter of Pollution of the Interstate Waters of the Colorado River and Its Tributaries in the States of California, Colorado, Utah, Arizona, Nevada, New Mexico, and Wyoming.

> A salinity policy ... adopted for the Colorado River system that would have as its objective the maintenance of salinity concentrations at or below levels presently found in the lower main stem. In implementing the salinity policy objective for the Colorado River system, the salinity problem must be treated as a basinwide problem that needs to be solved to maintain Lower Basin water salinity at or below present levels while the Upper Basin continues to develop its compact apportioned waters.

This policy was approved by the EPA (Enviromental Protection Agency) on June 9, 1972. The Administrator of the EPA and the Secretary of Agriculture were directed to cooperate and coordinate their activities with the Secretary of the Interior to effectively carry out the objectives of the program.

Public Law 98-569 was signed into Law on October 30, 1984, and amends Public Law 93-320. This legislation modifies the original salinity control program by authorizing construction of additional units and directing the Secretary of Agriculture to establish a major voluntary onfarm cooperative salinity control program. (See the Legislative Activities section for detail on amendments to the program.)

Participants

Reclamation was delegated the coordinating role for the Secretary of the Interior; and the Chief, Colorado River Water Quality Office, was appointed the designated salinity control liaison officer for Interior. As liaison officer, he coordinates the overall salinity control program with USDA (Department of Agriculture), EPA, the Colorado River Basin Salinity Control Advisory Council, and the Forum (Colorado River Basin Salinity Control Forum).

The FWS (Fish and Wildlife Service) activities are important to the implementation and progress of the CRWQIP. Five FWS offices are located in the Colorado River Basin. FWS provides guidance for replacing habitat potentially lost primarily through canal and lateral lining and onfarm programs.

The USGS (Geological Survey) Water Resources Division operates and maintains a network of 22 streamflow and water quality stations in the Colorado River drainage basin that are used in salinity program analysis. In addition to maintaining this hydrologic data network, the USGS has conducted, and continues to conduct, studies which have as objectives the analysis of temporal variations in salinity and definition of man's influence on salinity.

The BLM (Bureau of Land Management) has identified salinity source areas on public lands. Effective management for salinity control, including structures, is recommended and implemented where appropriate.

USDA involvement is provided primarily by the ASCS (Agricultural Conservation and Stabilization Service) and the SCS (Soil Conservation Service). Working through the USDA Salinity Control Coordinating Committee and a designated USDA salinity control liaison officer, ASCS and SCS provide major program management leadership and overall program coordination with Reclamation. However, USDA agencies and Title II onfarm salinity control programs are funded and implemented separately from Reclamation programs.

USDA implementation efforts are administered under existing program authorities. Financial assistance and landowner cost-share funding are being provided through specific appropriation language for the ACP (Agricultural Conservation Program) within the ASCS. SCS funding for technical assistance and monitoring are not specifically appropriated; therefore, the agency must rely upon the existing CTA (Conservation Technical Assistance) support to implement onfarm salinity control measures.

The ARS (Agricultural Research Service), the Cooperative State Research Service, and the Extension Service also play a vital role in the salinity control program. The ARS conducts research on irrigation water and soil management and on water delivery system design and operational practices. The Extension Service carries out educational programs to advise irrigators on water, soil, and crop management in saline areas.

The major EPA programs dealing with salinity control (Water Quality Standards, Water Quality Management Planning, and

NPDES permits) are largely delegated to the States. EPA maintains oversight and/or approval responsibilities for these delegated programs.

The Colorado River Basin Salinity Control Advisory Council was established by Public Law 93-320. The Advisory Council is composed of up to three representatives appointed by the Governor of each Basin State. It receives reports from the various Federal agencies working on the salinity control program and makes recommendations to the Secretaries of the DOI (Department of the Interior) and USDA and the Administrator of the EPA on the progress of implementation of the salinity control program.

The Colorado River Basin Salinity Control Forum was established in 1973 as a mechanism for interstate cooperation and to develop and adopt water quality standards for salinity including numeric criteria on the Colorado River. The standards were published in 1975 and were based on the objective of maintaining salinity concentrations at or below the 1972 levels found in the lower mainstem while allowing the Basin States to continue to develop their compact-apportioned waters. The Forum is composed of up to three representatives appointed by the Governor of each of the Basin States.

The seven Colorado River Basin States--Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming--have an important role in the salinity control effort. They are responsible for the control of the discharge of TDS (total dissolved solids) from point discharges through the NPDES permit program. California, Colorado, Nevada, and Wyoming have authority to issue all types of NPDES permits; New Mexico and Arizona prepare permits and forward them to EPA for issuance; and Utah issues its minor industrial permits while EPA handles the major industrial permits.

The States have primary responsibility for the adoption and enforcement of water quality standards. The numeric criteria (standards) established at Hoover Dam, Parker Dam, and Imperial Dam are 723 mg/L, 747 mg/L, and 879 mg/L, respectively. In addition to NPDES permits, the States have developed water quality management plans to conform with the requirements of Section 208 of the Clean Water Act.

Legislative Activities

The 98th Congress passed H.R. 2790 that amends Public Law 93-320, the Colorado River Basin Salinity Control Act. The President signed the bill on October 30, 1984, and the legislative initiative became Public Law 98-569. The following are highlights from the legislation:

- Directs the Secretaries of the Interior and Agriculture to give preference to those units that reduce salinity at the least cost per unit of salinity reduction;

- Provides for replacing canals and laterals with pipe in the Grand Valley Unit, Colorado;

- Deauthorizes the Crystal Geyser Unit, Utah;

- Authorizes two salinity control units: Stage I of the Lower Gunnison Basin Unit, Colorado, and the McElmo Creek Unit as a part of the Dolores Participating Project, Colorado, for construction by the Department of the Interior;

- Provides for replacing incidental fish and wildlife values foregone on the Department of the Interior units authorized for construction;

- Provides that the Secretary of the Interior submit final implementation reports to the Congress and to the Basin States prior to spending construction funds for the salinity control portion of the Dolores Project;

- Provides that the Secretary of the Interior's contracts for long term operation and maintenance of canal and lateral systems with irrigators and State wildlife agencies include:

    1. Provisions that the facility operators carry out normal annual repair and replacement activities necessary to assure continuing reductions in salinity,

    2. Reimbursement to the facility operators for operation and maintenance costs in excess of those that would normally have been incurred in the thorough and timely operation and maintenance of the system,

3. Replacement necessitated, through no fault of the operators, by design or construction inadequacies or the end of the useful life of a facility as a salinity program responsibility, including measures to replace fish and wildlife values foregone;

- Authorizes the Secretary of the Interior to provide continuing operation and maintenance technical assistance for canal and lateral systems;

- Authorizes the Secretary of the Interior to fund organization, construction, operation, and maintenance of private canals and laterals on authorized Department of the Interior units through grants or contracts;

- Directs the five authorized Department of the Interior units be implemented in accordance with several States' water laws;

- Authorizes the Secretary of the Interior to fund operation and maintenance of measures to replace incidental fish and wildlife values foregone through grants or contracts;

- Directs the Secretary of the Interior to concurrently implement replacement of incidental fish and wildlife values foregone with construction of authorized units;

- Provides that the Secretary of Agriculture may establish a voluntary salinity control program with landowners through a program including:

1. Identification of irrigation and watershed salt-sources;

2. Development of plans to improve irrigation water management, laterals, erosion management, and voluntary replacement of fish and wildlife values foregone;

3. Technical and cost-sharing assistance based upon implementation plans provided through contracts with individuals, groups, and other local nongovernmental agencies such as irrigation districts and canal companies, except that operation and maintenance must be provided without additional cost sharing, and that cost sharing be based upon benefits received with a minimum 30 percent provided by the participants unless determined

otherwise by the Secretary of Agriculture in order to assure implementation of onfarm measures;

4. Provisions for technical assistance for irrigation water management, monitoring of salt contributions to the Colorado River, and research, demonstration, and education activities;

- Directs the Secretary of Agriculture to report onfarm measures to be implemented, indicate report distribution, and prohibit expenditure of funds until 60 days after submission of the report;

- Allows the Secretary of Agriculture to use existing agencies or to authorize existing agencies to use grants or cooperative agreements with conservation districts or universities to carry out the onfarm program and to authorize funds to be appropriated annually for the onfarm program;

- Directs the Secretary of Agriculture to submit a report on the onfarm program to the Congress by January 1, 1988, and every five years thereafter;

- Directs the Secretary of the Interior to:

1. Develop a comprehensive BLM salinity control program by July 1, 1987,

2. Undertake feasibility investigations with industrial water users to dispose of saline and brackish waters,

3. Undertake advance planning on the Sinbad Valley Unit, Colorado.

- Provides for reimbursement by the Upper and Lower Basin funds of 25 percent of the costs of construction, operation, maintenance, and replacement, including fish and wildlife values foregone, for the previously authorized Department of the Interior units without interest within 50 years or less if the life of the facilities is of shorter duration;

- Provides for reimbursement by the Upper and Lower Basin funds of 30 percent of the costs of construction, operation, maintenance, and replacement of the Department of the Interior units authorized by P.L. 98-569, 30 percent of the Department of Agriculture onfarm cost share funding, and 30 percent of the measures to replace fish and wildlife values foregone as follows:

1. The Upper Colorado River Basin Fund's portion would be repaid with interest within 50 years or less if the life of the facilities is of shorter duration,

2. The Lower Colorado River Basin Development Fund's portion would be repaid either without interest during the year following the year the costs are incurred, or, if the fund is unable to repay during that year, with interest as soon as monies are available;

- Provides interest rate provisions reflecting realistic costs of borrowed monies to the Federal Government;

- Provides that operation and maintenance costs allocated to the two basin funds be repaid without interest the year after they are incurred and that any operation and maintenance costs due to irrigators, State wildlife agencies under contracts with the Secretary of the Interior, be repaid without interest the year after they are incurred;

- Deletes the provision for Congressional Committee disapproval of expenditure of funds;

- Provides that the Department of the Interior funds appropriated for construction, operation, maintenance, and replacement may be used for any or all of the authorized units.

A loose-leaf notebook was compiled by the Colorado River Water Quality Office bringing together legislative information and history of the Colorado River Basin Salinity Control Act. The book was distributed to Colorado River Basin Salinity Control Forum and Advisory Council members and to Federal agencies cooperating on program activities.

Evaluation Process

Figure 4 explains the agreed upon evaluation process used for this 1985 report. Overall, the process is essentially broken into four components: basic data, input considerations, evaluation and analysis, and review process.

The basic data component reflects DOI and USDA coordinated input of basic data on individual projects used in the evaluation process. Other input considerations were utilized to supplement the facts, figures, and values provided in the

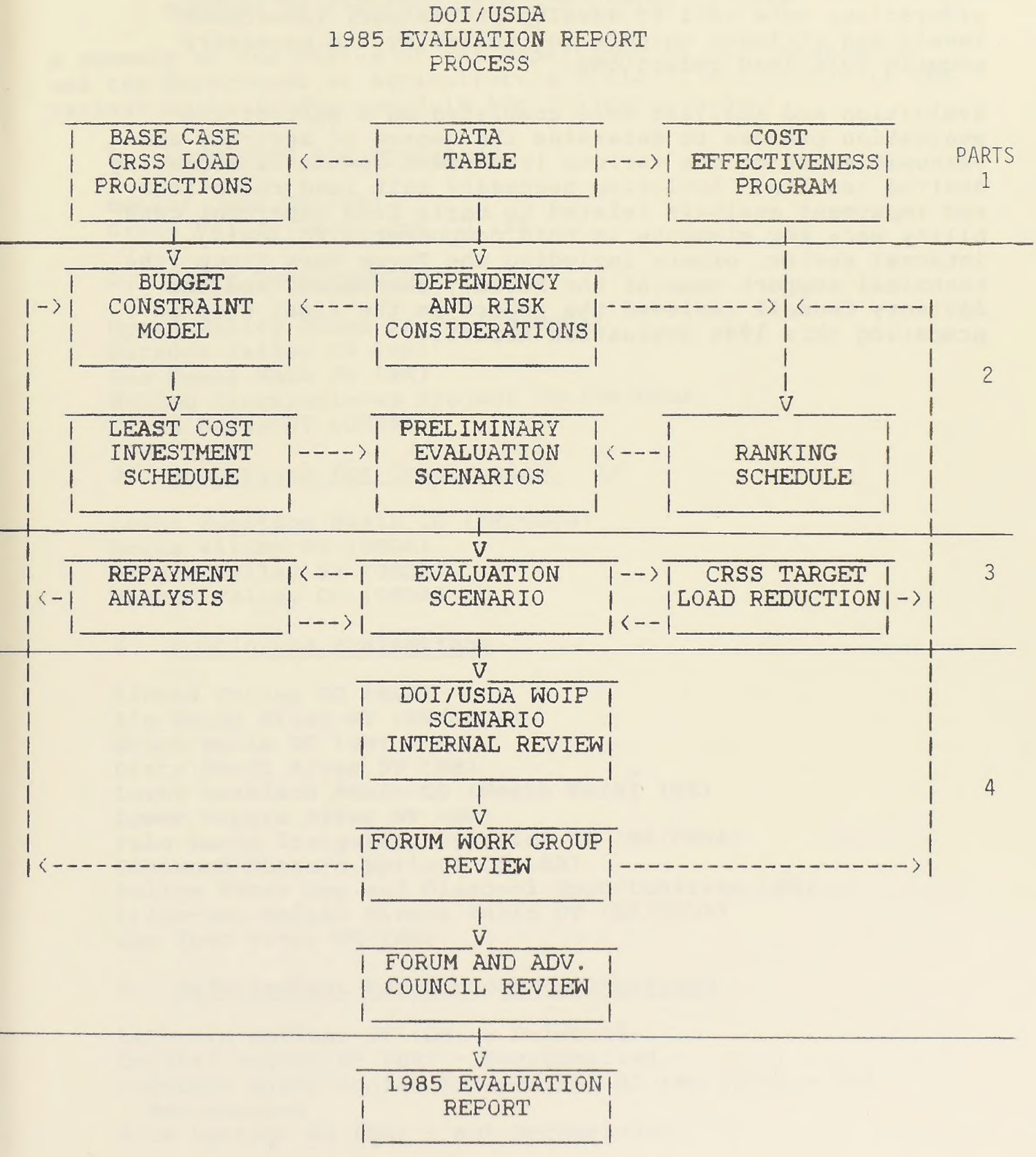


Figure 4. - DOI/USDA 1985 Evaluation Report Process

basic data. Collectively, the basic data and input considerations were used to develop preliminary investment levels and ultimate outputs for achieving the necessary program salt load reductions.

Evaluation and analysis were completed as a part of the evaluation process to determine the degree of accuracy and reasonableness of the various investment levels in achieving desired results. Achieving necessary salt load reductions and repayment analysis related to basin fund repayment capability were key elements in this component. Following internal review, others including the Forum Work Group (the technical support team of the Forum), the Forum, and the Advisory Council reviewed the report as the final step in preparing this 1985 Evaluation Report.

SUMMARY OF SPECIFIC UNIT ACTIVITIES IN 1985

A summary of the status of the Department of the Interior's and the Department of Agriculture's Title II activities in the various units is discussed in the following order:

1. Completed and Operating

Meeker Dome CO (BR)
Grand Valley Stage One CO (BR)

2. Under Construction

Grand Valley Stage II CO (BR/USDA)
Paradox Valley CO (BR)
Las Vegas Wash NV (BR)
McElmo Creek/Dolores Project CO (BR/USDA) 1/
Uinta Basin UT (USDA)

3. Authorized for Construction 1/

Lower Gunnison Basin CO (BR/USDA)
Moapa Valley NV (USDA)
Virgin Valley NV (USDA)
Mancos Valley CO (USDA)

4. Continuing Evaluations

Sinbad Valley CO (BLM)
Big Sandy River WY (BR/USDA)
Uinta Basin UT (BR)
Dirty Devil River UT (BR)
Lower Gunnison Basin CO (North Fork) (BR)
Lower Virgin River NV (BR)
Palo Verde Irrigation District CA (BR/USDA)
Glenwood-Dotsero Springs CO (BR)
Saline Water Use and Disposal Opportunities (BR)
Price-San Rafael Rivers Basin UT (BR/USDA)
San Juan River NM (BR)

5. Deferred/Not Recommended/Deauthorized

LaVerkin Springs UT (BR) - Deferred
Crystal Geyser UT (BR) - Deauthorized
Colorado River Indian Reservation AZ (BR/USDA) - Not Recommended
Blue Springs AZ (BR) - Not Recommended

1/ USDA projects' implementation is pending CRSC funding.

For more information on specific plans for Reclamation units, refer to the Status Report, Colorado River Water Quality Improvement Program, January 1983, published by the Colorado River Water Quality Office. For further explanation and background information on the scope and nature of the USDA program, refer to the USDA 1983 and 1984 Annual Reports, Colorado River Basin Salinity Control Program. The USDA reports are available from the USDA, Soil Conservation Service, Land Treatment Program Division, Box 2890, Washington, D.C. 20013.

A summary of the potential capabilities of the various units to remove salt, the amount of salt removed by operating units, and the associated cost effectiveness are shown in table 1. This information was derived from the basic data tables in Appendix A. Backup data are available in the Colorado River Water Quality Office.

The numbers in the following status descriptions are 1985 or the latest numbers available and may or may not be the same as the numbers (1984) in the basic data tables.

Completed and Operating

Meeker Dome CO (BR)

During verification studies, the abandoned Scott, James, and Marland oil wells were cleaned and plugged. A Planning Report Concluding the Study on Meeker Dome Unit, Colorado, completed in July 1985 reports a recent reduction in salt load of 19,000 tons, bringing the total salt load reduction to 50,000 tons. The salt reduction used in the model (described later) was 48,000 tons. Monitoring of observation wells will be continued to make sure that the well plugs remain intact.

Grand Valley Stage One CO (BR)

Seven miles of the Government Highline Canal lining, over 30 miles of Government Highline Lateral replacements, and the moss and debris removal structure are complete. The DPR (Definite Plan Report) projected a decrease of 24,000 tons from Stage One. Monitored results confirmed the removal of 19,900 tons per year based on Reclamation facilities in place. Hydrologic monitoring in the area is continuing.

Table 1. - Cost-effectiveness Summary in Best Cost-effectiveness Order (From Basic Data Table, Appendix A - 1984 Values)

Unit	Onsite at Project Area		
	Projected Salt Reduction (kton/yr)	Estimated Salt Reduction to Date (kton/yr)	Annual Cost Effect-iveness ($/ton)
Meeker Dome (BR)	48.0	48 3/	14
Virgin Valley (USDA)	37.2		16
Las Vegas Wash, Whitney (BR) 1/	10.0 2/		16
Lower Gunnison, WW (BR)	74.3		17
Las Vegas Wash, Stg II (BR)	66.0 2/		17
Grand Valley (USDA)	230.0	27.3	23
Las Vegas Wash, Pittman (BR) 1/	7.0	7	24
Big Sandy (USDA)	52.9		25
Paradox Valley (BR)	180.0		32
Lower Gunnison (USDA)	335.0		32
Moapa Valley (USDA)	19.2		35
Price-San Rafael Rivers (BR)	22.0		47
Mancos Valley (USDA)	8.8		56
Uinta Basin (USDA)	82.6	15.6	59
McElmo Creek (USDA)	38.0		67
Lower Virgin River (BR)	270.0		69
Uinta Basin Stage I (BR)	25.5		85
Dolores Project (BR)	23.4		89
Grand Valley Stage Two (BR)	120.3		93
Dirty Devil River (BR)	20.6		97
Sinbad Valley (BLM)	7.5		101
Glenwood-Dotsero Springs	287.0		109
Grand Valley Stage One (BR)	24.0	19.9	123
Lower Gunnison Stage I Balance (BR)	66.3		183
Grand Valley Stage Two Balance (BR)	23.2		297
Lower Gunnison N Fork (BR)			
San Juan River (BR)			
Uinta Basin Stage II (BR)			
Price-San Rafael Rivers (USDA)			
Big Sandy River (BR)			
PVID (BR/USDA)			

1/ Stage I
2/ Best estimates at this time
3/ Cost effectiveness based on 19,000 tons

Under Construction

Grand Valley Stage Two CO (BR/USDA)

Reclamation's data collection for the Stage Two area specifications and designs are underway. Reclamation funded the Colorado Water Conservation Board to do a study of how best to consolidate private lateral organizations into legal contracting entities. Private lateral organization structure was discussed in several meetings during the year and some progress has been made.

The Colorado Division of Wildlife final report on Stage One wildlife monitoring was submitted. The results of three years monitoring changes in fish and wildlife in Stage One were used in preparing the Environmental Statement on Stage Two and in developing fish and wildlife habitat replacement for the Stage One area.

USDA's onfarm and off-farm lateral improvements in Stage One and Stage Two Grand Valley have been accomplished primarily through the annual practice cost-share provision of the ASCS's ACP program. Onfarm pipeline and ditch lining installed during 1985 was 136,961 feet and 23,594 feet respectively. Total onfarm pipeline and ditch lining accomplishments thus far are approximately 140 miles of pipelines and 40 miles of ditch lining. Combined, these accomplishments represent about 27 percent of the total Grand Valley project goal.

USDA's off-farm lateral improvements for 1985 consisted of 18,823 feet of pipeline improvements and 2,734 feet of ditch lining. Total off-farm lateral accomplishments for the project are 36.4 miles of pipelines and 11.1 miles of ditch lining, representing 25.1 percent of the overall project goals.

USDA's onfarm seepage or deep percolation reductions from all treatments to date are estimated to be 4,023 acre-feet per year for an average salt load reduction of 20,231 tons per year. Off-farm lateral seepage reductions from all treatments to date are 2,242 acre-feet per year for 11,277 tons of salt load reductions per year. Total seepage/deep percolation reductions are 6,265 acre-feet for 1985 for a 31,508 tons per year salt load reduction from USDA activities in both Stage One and Stage Two.

Paradox Valley CO (BR)

Deep well injection still appears the most cost-effective solution for disposal of collected brines. Geophysical data

interpretation by two independent contractors led to the selection of a test well site. The well plan is complete and land has been purchased for the test well. The solicitation/RPF (request for proposals) was prepared for the 15,400 foot deep injection well using advance design features to handle the high pressure and temperature corrosive brine. Reclamation issued the RPF's for the well drilling on November 1, 1985.

The contract award for the well drilling is scheduled for June 1986. The entire test well program is scheduled to be completed by 1990.

Las Vegas Wash Unit NV (BR)

The 3.5 mile Pittman bypass pipeline was completed and is in operation. A monitoring program began June 20 to evaluate the effectiveness of the pipeline to prevent seepage. The expected salt reduction of 7,000 tons per year is included in data base.

Another strategy which may be cost-effective to further reduce salinity loading is using ground water barriers in selected areas of the Wash to develop a ground water detention basin system. Each detention basin would be formed by a peripheral slurry trench/wall. An 8,000 foot perimeter dike and slurry trench/wall will be constructed near the Whitney area (now part of East Las Vegas) to verify the feasibility of this strategy. If a detention basin system appears feasible after 2 years of monitoring, additional basins may be built. The construction of ground water detention basins may accomplish the equivalent salinity reduction expected from the bypass channel for the same cost with less local opposition. The proposed Whitney Verification program will also evaluate a vegetative test site and involve other water quality monitoring activities in the Wash.

McElmo Creek/Dolores Project CO (BR/USDA)

Reclamation's planning activities for the McElmo Creek Unit were concluded with the passage of Public Law 98-569. Salinity control features will now be constructed under the Dolores Project.

Supplements to the Definite Plan Report and Final Environmental Statement of the Dolores Project will be drafted in 1986 and 1987 for filing with EPA. Final approval by the Commissioner of Reclamation is expected in the spring of 1988.

The supplements will document the plan to combine the Highline Canal with the Towaoc Canal, a feature of the Dolores Project, to create the Towaoc-Highline Combination Canal. The features of the McElmo Creek Unit to be discussed in the supplement include abandoning the Rocky Ford Ditch, installing buried pipe laterals from the Towaoc-Highline Combination Canal to the Rocky Ford service area, and lining segments of the Lone Pine and Upper Hermana Laterals. Other modifications to features not related to salinity in the Dolores Project will also be documented.

The awarding of the first construction contract for salinity-related features, Reach 1 of the Towaoc-Highline Combination Canal, is now scheduled for the spring of 1989. Construction of all features will be completed in the fall of 1993. Expected salt load reduction to the river system will be 23,400 tons per year for the off-farm element.

The McElmo Creek USDA salinity control report was published in 1983. The recommended implementation plans call for treatment of about 19,700 acres with sprinkler irrigation systems (10,400 acres gravity and 9,300 acres pumped) and about 270 miles of onfarm ditch and lateral lining. By combining the DOI Dolores Project and the McElmo Creek salinity project, the more efficient gravity pressure sprinkler systems can be installed to an additional 9,000 acres over the original USDA implementation plan. The DOI and USDA projects are fully compatible; however, it is extremely critical that a fully coordinated effort be initiated so the design and implementation of DOI delivery and distribution systems complement the design and installation of onfarm systems. A reevaluation of the USDA implemetation schedule will be necessary to allow for coordinated onfarm and off-farm planning.

Uinta Basin UT (USDA)

To date, over eighty percent of the Uinta Basin USDA onfarm and supportive off-farm salinity control improvements have been implemented through the use of LTA's (Long Term Agreements). More than ninety percent of the participants who entered into LTA's have done so through pooling arrangements whereby two or more participants develop mutually beneficial plans. A major emphasis has been placed on comprehensive planning and LTA preparation. Participants are assisted in implementing a well-balanced improvement program of structural and management practices that address salinity reduction and wildlife habitat enhancement.

In FY 1985, 70 LTA's were authorized for implementation. These agreements, when completed, will minimize salt loading

impacts from 3,368 acres of irrigated cropland and 4,500 linear feet of off-farm irrigation system laterals. In addition to practices in LTA's, 55 annual practices were installed which partially treated 1,485 acres of irrigated cropland.

At the end of FY 1985, salinity program participants had achieved irrigation water management on 18,000 acres, reducing salt loading to the Colorado River by an estimated 15,447 tons. Treatment of 23,169 linear feet of off-farm laterals has reduced salt loading by an additional 3,711 tons. Overall, average annual salt reduction to date has been 19,158 tons. Approximately 26 percent of project funds have been obligated and approximately 19 percent of projected salt load reduction benefits have been achieved.

Authorized for Construction

This section discusses DOI projects that have been authorized for construction and USDA projects which have met the prerequisites for construction and are awaiting funding.

Lower Gunnison Basin Stage I (BR/USDA)

The Uncompahgre portion of Reclamation's Lower Gunnison Basin Unit was authorized under Public Law 98-569 signed on October 30, 1984. Advance planning studies were initiated on the winter water portion in FY 1984. The winter water replacement plan alone would reduce salinity at Imperial Dam by about 74,300 tons with the total plan reducing salinity by 140,600 tons.

The Tri-County Conservancy District indicated willingness to extend their contract with Reclamation to include collection of onfarm preconstruction design data and cost estimates of the winter water features.

The SCS onfarm report completed in September 1981 outlines an implementation plan that is compatible with the Reclamation plan. A more cost-effective subarea is expected to be identified for high priority implementation.

Moapa Valley NV (USDA)

SCS published its report on Moapa Valley in February 1981. The project covers a 5,000 acre irrigated area on Muddy River upstream of Lake Mead. The project includes installation of 17 miles of underground piped delivery system, onfarm water management, and salinity control practices.

By reducing overirrigation and excessive deep percolation, it is estimated average annual salt load reductions to the Colorado River system will be 19,200 tons. Colorado River Basin Salinity Control Forum Work Group members made a tour of the Moapa Valley during March 1985.

Virgin Valley NV (USDA)

The Virgin Valley report was published in September 1981. The area consists of about 5,000 acres of irrigated land owned by about 50 individuals. Four irrigation companies or districts would also be involved with improvements of about 6 miles of off-farm canal and lateral improvement. Deep percolation reduction is estimated to be 19,000 acre-feet per year and salt load reductions are estimated to be 37,200 tons per year.

While the Virgin Valley is independent of any Reclamation salinity control project, the downstream impacts on Reclamation's Lower Virgin River Unit are to be evaluated by Reclamation and SCS collectively. Forum Work Group members also made an orientation tour of the Virgin Valley during March 1985.

Mancos Valley CO (USDA)

The Mancos Valley unit is a 9,200 acre irrigated area along the Mancos River, a tributary to the San Juan River. The report, Irrigation Improvements for Mancos Valley, was completed in 1985. The recommended implementation plan includes 3,200 acres of sprinkler systems and other water management/salinity control treatments on about 5,500 total acres. About 17 miles of canal and lateral lining would combine many old earthen laterals. Total salt load reductions are estimated to be 8,800 tons per year with about 7,700 tons resulting from lateral improvements. About 57 landowners and 15 lateral companies or groups of landowners would be involved. A tour of the Mancos Valley was conducted during the Colorado River Basin Interagency Committee meeting in June 1985.

Continuing Evaluations

Sinbad Valley CO (BLM)

The Sinbad Valley Salinity Report was completed in April 1983. The report identifies seven alternatives for this salinity control unit in western Colorado. Public Law 98-569 directed the Secretary of the Interior to undertake advance

planning activities on the unit, but funding was not provided, greatly reducing BLM's capability.

Streamflow and water quality data are currently being collected on Salt Creek in Sinbad Valley. Basic data collection is the only ongoing activity of the study.

Recent discussions between Reclamation and BLM have led to an agreement that Reclamation will fund and perform advance planning activities. Funding will not be available, however, until 1988.

Big Sandy River Unit WY (BR/USDA)

Although USDA has a published report, there is no recommended plan. A low pressure sprinkler system alternative appears to be cost effective for the 15,000 acre irrigation salt source area if supplemental, low interest loans and cost sharing at the 70 percent level were obtained. The State of Wyoming supports this USDA low pressure sprinkler alternative and has requested SCS to proceed with development of a selected plan.

The State of Wyoming has also requested Reclamation to refine the salt and water budget related to selected lining of canals and laterals in the Eden-Farson area. Planning will be targeted toward selected lining of unlined segments of the canal and lateral system.

The combination of off-farm delivery system and onfarm irrigation efficiency allows the SCS to recommend low pressure sprinkler systems for onfarm salinity program elements. SCS and Reclamation will continue the evaluation of these alternative treatments.

Uinta Basin Unit UT (BR)

Reclamation's preferred plan consists of lining about 55.5 miles of canals and laterals and is estimated to reduce salt loading by about 25,500 tons annually. This portion of the study was completed in FY 1985 and the Regional Director's draft planning report/advance draft environmental statement has been distributed for review.

Studies on the remaining portion of the study area will address the Indian and non-Indian irrigation distribution systems not considered in the first portion, including Ashley Valley, and the potential for the collection and industrial use of saline water. Studies are scheduled to be completed in FY 1990.

Dirty Devil River UT (BR)

The estimated salt load contributed by the river is 150,000 tons annually. At present, Reclamation's preferred plan is the deep well injection of brines at Hanksville South Salt Wash near Hanksville, Utah, and Emery South Salt Wash near Emery and Green River, Utah. The recommended plan would reduce the salt load by about 19,200 tons annually.

The deep well injection permit application is pending. The Utah State Engineer's Office has recommended the possibility of granting a limited time water right rather than a permanent water right for injection. The schedule calls for completing the Upper Colorado Regional Director's Final Planning Report/Draft Environmental Impact Statement (PR/DES) in September 1986.

Lower Gunnison Basin, North Fork Area CO (BR)

Reclamation's plan formulation investigations are continuing on the North Fork area. The Regional Director's Report and Draft Environmental Statement are scheduled for completion in August 1990.

The SCS has completed its salinity control study for onfarm sources in the North Fork area and has estimated that about 200,000 tons of salts enter the Colorado River system from off-farm canal and lateral related sources. In addition, some saline springs are known to exist in the area. There are numerous irrigation channels within the area, and much of the soil is derived from or is underlain by Mancos shale. Reclamation's study objective will be to delineate the salt loading areas, develop a salt loading mechanism model, formulate alternative solutions to the problem, and select one or more recommended courses of action.

Lower Virgin River Unit NV (BR)

Studies were programed by Reclamation to investigate the viability of capturing Lower Virgin River saline underflows and diverting them for use as powerplant cooling water in southern Nevada. Up to 50,000 acre-feet of saline water could be used for this purpose. The salinity of the subsurface Virgin River water ranges from 2,000 to 4,000 mg/L. The State of Nevada and Nevada Power Company are interested in this project. A contract study is planned to determine if Nevada Power Company can use this water as an alternative source.

FY 1985 funds provided for investigation of the potential alternatives for the collection, conveyance, and use of the

saline water. FY 1986 activities will include drilling test wells to provide water samples, ground water elevations, and hydrology data. The study is scheduled for completion in FY 1989. Study activities are being coordinated with USDA's upstream activities in the Virgin Valley Unit.

Palo Verde Irrigation District Unit CA (BR/USDA)

In FY 1985, SCS and Reclamation formulated a joint plan of study. SCS will provide Reclamation with onfarm, onsite evaluations and analyses relative to irrigation efficiencies, deep percolation, and prospects for improved onfarm management. The USDA portion of the evaluation, however, has not yet been funded pending the outcome of Reclamation's Phase I work. Reclamation completed the shallow well drilling for the verification program in May 1985 and is sampling the test wells.

FY 1986 Reclamation activities will complete Phase I work in developing hydrosalinity analysis for the Palo Verde Irrigation District Unit to determine the movements of ground water and source of salt loadings. The study will provide information for Reclamation, USDA, and the Palo Verde Irrigation District to determine salinity control program components and the need for further studies.

Glenwood-Dotsero Springs Unit CO (BR)

The Regional Director's Proposed Planning Report/Advance Draft Environmental Statement was completed in FY 1985 and was released to the Forum and to appropriate Federal agencies for field level review. A decision was made, following consultation with the Forum, to defer further investigation. A draft Planning Report Concluding the Study was sent to Washington on September 30, 1985.

The plan (evaporation pond disposal) is not being pursued since it is not as cost-effective as other plans being implemented in the basin and, under Colorado water law, evaporation is not considered a beneficial use of water.

Saline Water Use and Disposal Opportunities (BR)

Saline Water Cooling System Verification Program - The contract study of saline water use in Jim Bridger Power Plant found that by using side-stream softeners and disposal ponds, about 8,000 acre-feet per year of Big Sandy River water could be used with total in-plant costs of about $70 per ton of salt removed. When the costs of well collection features and pipeline costs are included, the total cost-

effectiveness estimates for using Big Sandy River flows in the powerplant ranged from $146 to $152 per ton of salt. These costs are not competitive with other salinity control units at this time. A Final Report on the Jim Bridger Power Plant study was distributed and is available in limited quantities from the Water Quality Office in Denver.

Installation of a saline water cooling system at Etiwanda Power Plant at Ontario, California, appears to be the most cost-effective way to verify that the use of saline water provides salinity control benefits and addresses the concerns of the industry regarding equipment performance.

A letter of agreement for cost-sharing the Etiwanda Power Plant Verification Program, equipment design, and an operational plan for installing and operating the verification unit was completed in FY 1985. Installation of the verification facilities began in FY 1985.

Cost-sharing for the program is provided by Reclamation, EPA, State of California, Sephton Water Technology, Pacific Gas and Electric, and Southern California Edison.

Westrans - In an agreement signed March 18, 1985, Western Resource Transport, Inc. (Westrans), of Tulsa, Oklahoma, indicated it will devote resources to study, plan, and develop projects that will divert saline water from the Colorado River Basin and carry it by pipeline to points of beneficial use in industry and for energy development. The agreement also spells out ways Reclamation will aid Westrans, Inc. (formerly Aquatrain, Inc.), in planning a liquid carbon dioxide/coal slurry pipeline to be built by the firm and other investors.

As of October 31, 1985, the Saline Water Transport and Use Office, Denver, Colorado, was closed. Administration of the study and the cooperative agreement was transferred to the Regional Planning Officer, Upper Colorado Regional Office, Salt Lake City, Utah. When the Westrans Project progresses to the point of funding Bureau of Reclamation participation, Reclamation will then staff up to meet the needs of the joint program.

Price-San Rafael Rivers Unit UT (BR/USDA)

After evaluating the salt sources in the two valley areas, Reclamation has recommended a plan to improve stock watering practices. Additional stockwater ponds would be provided and existing ones would be improved by enlarging and lining to reduce seepage. In some areas, domestic water systems

could be expanded to provide supplemental supplies to stockwater users.

Reclamation and SCS are looking at new combined alternatives that would include placement of laterals in pipe and a combination of the laterals with the gravity sprinkler irrigation systems. SCS and Reclamation are evaluating potential for a joint and fully coordinated salinity project which may result in SCS-BR reports on two subareas.

USDA has participated in public meetings to discuss onfarm salinity program and has kept the local sponsors informed on opportunities for funding and technical assistance.

San Juan River Unit NM (BR)

The study area is from the headwaters of the river in south central Colorado, through northwestern New Mexico, to its mouth at Lake Powell in southeastern Utah. Data show an average annual flow of 1,615,000 acre-feet at Bluff, Utah, carrying a salt load of 961,000 tons. Preliminary estimates of the salt load in the river between Shiprock, New Mexico, and Four Corners indicate a salt pickup of about 171,000 tons annually, corresponding to an increase in flow of only about 95,000 acre-feet. Investigations are proposed to begin in FY 1986 and be completed in FY 1989.

Deferred/Not Recommended/Deauthorized

LaVerkin Springs Unit UT (BR) - Deferred

The Preliminary Findings Report recommending discontinuance of the study because of poor cost effectiveness was released on August 7, 1984. This recommendation has been concurred in by the Salinity Control Forum and the Commissioner's Office.

Crystal Geyser UT (BR) - Deauthorized

Crystal Geyser is an abandoned oil well just south of Green River, Utah. It is too costly to remove the 200 acre-feet of water and 3,000 tons of salt contributed by the geyser. Public Law 98-569 signed on October 30, 1984, deauthorized this unit.

Colorado River Indian Reservation AZ (BR/USDA) - Not Recommended

Reclamation's appraisal level study of the reservation found that it did not add sufficient soluble material to the Colorado River to warrant further study. Therefore, a concluding report was issued in October 1979.

A Cooperative River Basin Study has been completed by USDA on the Colorado River Indian Reservation. Data available from this study support the hypothesis that a minimal amount of salt is picked up on the Reservation and that long-term benefits of better irrigation systems and practices appear to have a relatively small effect on downstream salinity. The final USDA report on the study, Water Conservation and Resource Development, Colorado River Indian Reservation, which did not identify a recommended plan, was recently published and distributed under authority of Section 6 of the Watershed Protection and Flood Prevention Act (Public Law 83-566).

Blue Springs AZ (BR) - Not Recommended

Because of the environmental objections and the significant historical and religious value of the area to the Hopi Indians, together with the expected high capital cost of the project, further studies for the project have not been recommended.

SUMMARY OF OTHER ACTIVITIES IN 1985

Title I

To satisfy the requirements of Minute 242 of the International Boundary and Water Commission, Title I of Public Law 93-320 authorizes the construction of several permanent measures downstream from Imperial Dam and makes the replacement of bypass and reject waters a Federal obligation.

The seven measures to be implemented under Title I are:

1. construction of the Yuma Desalting Plant; (under construction)

2. construction of the Bypass Drain in the United States and Mexico; (completed in 1977)

3. implementation of measures for Wellton-Mohawk irrigation efficiency improvement (Irrigation Management Services, Onfarm Systems Improvement, Research and Demonstrations, Education Program, Technical Field Committee); (measures being implemented)

4. Wellton-Mohawk acreage reduction; (completed in 1979)

5. Painted Rock Reservoir land acquisition and operation schedule modification; (acquisition pending Federal court action to determine whether the Corps of Engineers has legal authority)

6. construction of the MODE (main outlet drain extension) Siphon; (construction completed in 1976)

7. fish and wildlife mitigation measures; (mitigation measures are ongoing).

In addition, Title I authorizes replacement of the first 49 miles of the existing earthlined Coachella Canal with a concrete-lined canal to reduce seepage and to salvage about 132,000 acre-feet of water annually. Construction was essentialy complete for the canal but peripheral contracts are in effect related to the purchase and installation of control equipment for the canal. Title I also authorizes the Protective and Regulatory Pumping Unit which consists of well fields and a lateral collection system to enable the United States to pump up to 160,000 acre-feet annually within 5 miles of the Southerly International Boundary.

Construction was essentially completed in 1983. Most of the pumping (140,000 acre-feet) will be delivered to Mexico across the land boundary at San Luis to satisfy the 1944 treaty.

In March 1985, Reclamation awarded the last of three major contracts for the construction of the Yuma Desalting Plant at Yuma, Arizona. The $35 million contract was awarded to complete the desalting plant pretreatment facilities and to construct equipment and office buildings. The contractor will have 3-1/2 years to complete the work. Pretreatment start-up is planned for mid-1987, and the desalting plant is scheduled for completion in late 1989 or 1990.

USDA's involvement relates specifically to onfarm treatments and water management improvements in the WMIDD (Wellton-Mohawk Irrigation and Drainage District) in Yuma, Arizona. Any reduction of drainage return flows would reduce the demands and costs of operating the desalting plant. By improving irrigation efficiencies, a reduction of deep percolation into ground water reduces the amount of drainage return flows leaving the 65,000 acre WMIDD.

The Wellton-Mohawk onfarm Federal cost-sharing program is fully funded by Reclamation. Under authority of a BR-SCS Title I Memorandum of Agreement (December 1974), Reclamation reimburses SCS for cost-sharing and technical assistance provided to individual participants through long-term contracts. The initial program for 23,800 acres was expanded during the annual renewal of the agreement in 1984 to 48,000 acres.

This last renewal provided that all SCS contracting would be completed by September 30, 1985, and that all water management and salinity control land treatment practices would be installed by December 31, 1985.

In 1985, 55 contracts were developed and signed covering 4,519 acres. Practices applied included 31 miles of ditch lining, 4,822 acres of laser land leveling, and 787 structures for water control and measurement.

The SCS is designing and assisting farmers to install irrigation systems to reduce irrigation return flow. As of September 1985, 376 contracts have been developed for assistance on 48,588 acres. Treatment will exceed the 48,000 acre project goal. Since implementation of the Colorado River salinity program began in 1975, the irrigation return flows have been reduced about half or approximately 100,000 acre-feet.

Title II DOI Activities

Bureau of Reclamation

In addition to construction of three units and planning activities on 12 units, Reclamation is carrying out research programs utilizing expertise in the Engineering and Research Center on such activities as solution mining with saline water, solar salt gradient ponds, ion exchange softening, and use of saline water in aquaculture.

The activities in the CREST (Colorado River Enhanced Snowpack Test) program were minimal in 1985. Funding has not yet been received for the tests. For details regarding this program, please refer to the 1984 Evaluation Report and its appendix.

BLM (Bureau of Land Management) Activities

The BLM has numerous small salinity control projects which are now completed and in operation. These projects include both point and nonpoint source controls. Point source projects include the plugging of the wells located in the Piceance Creek drainage basin in Colorado, and one well located in the Bitter Creek drainage in Wyoming. Plugging accounted for approximately 7,000 tons of salt removed per year.

Nonpoint source controls included numerous erosion/salinity control structures placed throughout Colorado, Utah, and Wyoming. Most notable of these was Elephant Skin Wash near Montrose, Colorado. Other drainages where structural control has been implemented include Lower Wolf Creek, and Cactus Park, Colorado; Red Creek, Wyoming; and Sagers Wash, Utah.

The Elephant Skin Wash salinity control project to retain salt and sediment laden runoff was completed in 1985. The small ponding dikes and diversion dams will reduce the salt load by 29 tons per year at a cost effectiveness of about $30 per ton of salt removed.

The BLM has also identified salinity control as a program objective and proposed activity in several Resource Management Plans within the Colorado River Basin.

FWS (Fish and Wildlife Service)

The FWS is currently involved in studies with 13 of the salinity control units. FWS also provides input into planning activities through participation in a variety of working/planning meetings with all entities involved in the salinity program.

Specific suggestions for replacing habitat potentially lost through canal and lateral lining and onfarm programs were provided in the Grand Valley Unit area in 1985. A planning aid letter was submitted on the Uncompahgre Valley area of the Lower Gunnison Basin with suggested alternatives for habitat replacement.

GS (Geological Survey)

In addition to the 22 stations maintained strictly for the analysis of salinity control program benefits, the Geological Survey conducts hydrological assessments and maintains a much larger hydrologic data network. Results of these studies and information from the data networks form the basis for a better understanding of salinity variations. As an integral part of the hydrologic studies, the Water Resources Division has developed a data base to support site specific salinity studies as well as to evaluate data at several key stations in the river system.

Title II USDA Activities

The passage of Public Law 98-569 provides a separate authority for implementing a basin-wide onfarm program. Funds, however, have not yet been appropriated for the program. Until then, as prescribed by the provisions of Title II of Public Law 93-320, USDA will continue to use existing program authorities.

Planning

Within USDA, planning activities are a responsibility of the SCS. Once irrigated agricultural salt source areas have been identified, SCS undertakes salinity control studies and investigations to determine the extent and severity of salt source loadings. These studies and investigations are conducted under the river basin authorities of Section 6 of Public Law 83-566, Watershed Protection and Flood Prevention Act. These studies are fully coordinated with Reclamation activities and serve as the basis for detailed project implementation plans.

In 1985, only a minimal amount of planning effort was undertaken due to limited funding. The two reports released in 1985 were the Mancos Valley, published in September 1984, and the Colorado River Indian Reservation, published in May 1985. Table 2 presents a status report on USDA irrigation salt source unit studies.

Table 2 - USDA Status Report
Irrigation Salt Source Projects

Area	Planning Completed	Implementation
1. Grand Valley (CO)	Dec. 1977	Modified schedule extends assistance to 1993
2. Uinta Basin (UT)	Jan. 1979	Modified schedule extends assistance to 1994
3. Big Sandy (WY)	Nov. 1980	No recommended plan, selective off-farm canal lining and onfarm low pressure alternatives being reassessed
4. Moapa Valley (NV)	Feb. 1981	Pending funding
5. Lower Gunnison (CO)	Sept. 1981	Proposed to rescope implementation plan with priority areas and implementation phases
6. Virgin Valley (NV, AZ)	March 1982	Pending funding
7. McElmo Creek (CO)	Jan. 1983	Extended to future years
8. Mancos Valley (CO)	Sept. 1984	Extended to 1995 - subject to change
9. Little Colorado River (AZ)	Dec. 1981	No recommended plan or salinity control benefits identified
10. Colorado River Indian Reservation (AZ)	May 1985	No recommended plan or salinity control benefits identified
11. Palo Verde Irrigation District (CA)	Pending	Anticipate SCS and USBR joint planning when funded
12. Price-San Rafael (UT)	Underway	USBR and SCS investigating formulation of joint plan
13. Upper Virgin (UT)	Suspended	No plans to resume study at this time

Implementation

Current implementation activities are concentrated in the Uinta Basin, Utah, and the Grand Valley, Colorado. Implementation of the USDA onfarm program is the responibility of the ASCS and SCS. Currently, USDA is relying on the existing program authorities and funding for project implementation. The ACP (Agricultural Conservation Program) of ASCS is providing special cost-share funding for water management and salinity control practices. SCS is using funds allocated through their ongoing CTA (Conservation Technical Assistance) program to provide the necessary technical support staff to plan and implement the water management and salinity control practices.

The current implementation schedule is controlled by annual appropriation funding levels. While USDA developed a modified implementation schedule in 1982, funding has only supported the two ongoing projects. Other project implementation starts are scheduled to be phased in over a period of years as program funding levels increase.

A new implementation schedule will be formulated as a result of new legislation, closer coordination with Reclamation, and inputs from the Basin States. The new implementation schedule will be based upon projected salt load reduction needs, cost-effectiveness analysis, the likelihood of Federal funding, and Basin Fund repayment capability. This new schedule will be developed during the 1986 evaluation process.

Extension Education

Information and educational support activities for the CRWQIP have been provided through the USDA Federal Extension Service and the State CES (Cooperative Extension Service) agencies. Like ASCS and SCS, the Extension Service and the State CES agencies have relied on existing authorities and funding mechanisms to provide the extension education support. Existing extension staffs such as Extension Agents and Extension Irrigation Water Management Specialists have provided some general levels of limited education support. These include newsletters, water management workshops, and other educational efforts as a part of their ongoing extension education programs.

A special full-time irrigation extension agent in Grand Valley was the most significant extension education support in recent years. Lack of funding caused termination of the position in 1985. This sort of extension education support

could play a valuable and important role in project visibility, local understanding, and local acceptance.

Research and Demonstration

Research and demonstration activities continue to be important to the development of new technologies and improvement of water management practices for control of soil and water salinity. The ARS provides national leadership for salinity related research and demonstration activities. In addition, the CSRS (Cooperative State Research Service) and SAES (State Agricultural Experiment Stations) provide the leadership and conduct research funded from Federal and State sources.

Agricultural Research Service - The majority of the ARS salinity activities are conducted at the U.S. Salinity Laboratory in Riverside, California; the U.S. Water Conservation Laboratory in Phoenix, Arizona; the Agricultural Engineering Research Center in Ft. Collins, Colorado; and the Snake River Conservation Research Center at Kimberly, Idaho. More detailed discussions and explanations are provided in the 1984 USDA Annual Report.

The drainwater reuse project in the Imperial Valley of California involves the use of saline drainwater as a partial source of irrigation water at different stages of crop growth. Research has been underway for 3 years on rotations of cotton, sugar beets, and wheat. Drainwater of about 3,000 mg/L has been substituted for 50 to 75 percent of irrigation water without reducing crop yield.

In Grand Valley, ARS scientists have been studying the use of stable isotopes to determine the relative quantities of local ground water that originates from Colorado River water, precipitation, and lateral ground water flows from nonirrigated areas. Preliminary results indicate about 1/3 of the wells sampled contain ground water from other than Colorado River origin. Separation of deep percolation and canal/lateral seepage losses in ground water is still under investigation. Results of these isotope study findings should be available for release in 1986. ARS scientists at Fort Collins are evaluating the use of improved soil infiltration characteristics to further improve the design and management of graded furrow irrigation systems in Grand Valley.

The U. S. Water Conservation Laboratory in Arizona is monitoring irrigation water delivery systems and the interaction of hydraulic conditions and water management decisions to

provide a data base for improving open channel delivery systems. Measuring devices and instrumentation equipment have been installed on several canals in the Imperial Irrigation District (CA) and Wellton-Mohawk Irrigation and Drainage District (AZ). By 1986, all devices and instrumentation should be fully operational for monitoring during the entire irrigation season.

Several years of cablegation irrigation research and field demonstration has been completed by ARS scientists from Kimberly, Idaho. Thus far, experiences in Grand Valley have been very encouraging and successful.

Cooperative State Research Service - State Agricultural Experiment Stations - Scientists from the Great Plains westward have conducted substantial research on soil salinity that is relevant to the solution of salinity control problems in the Colorado River Basin. Some examples of SAES research in the Western Regional Project W-160 are presented below.

Research by Utah State University scientists in cooperation with Utah Power and Light since 1977 relates to the use of wastewater from the coal-fired powerplant at Huntington, Utah. Crops have been grown for 8 years and soil salinity has been monitored. Wastewater was applied by specialized line-source equipment at rates ranging from excess, which caused leaching, to no leaching. The saline water from the powerplant is about ten times saltier than the normal "creek" irrigation water. The build-up of total salts was sufficient to cause some minor yield depressions. Tests made in 1985 definitely show the major detrimental effect found was boron toxicity, which was highly dependent on the crop. The forage crops tested showed no yield depression due to these boron rates but potato yields were decreased to 20 percent of normal. The susceptibility of crops was found to be (from high to low susceptibility) potatoes, corn, barley, wheat, alfalfa, wheatgrass. A model of water-boron-crop-irrigation-yield has been developed and is in the process of being tested against field data.

A University of California-Davis study of factors influencing carbonate chemistry and minerology in salt affected soils was carried out over a 3-year period. Plots were designed to provide delivery of variable quantities of irrigation water and salts through parallel line-source sprinklers. The plots were cropped to sorghum during summer seasons and to wheat during winter and early spring. Soil solutions and soil gases were collected periodically to study seasonal and diurnal periods, varying temperature,

moisture, and salinity regimes on cropped and noncropped conditions. Data applied to the WATEQF water equilibrium model showed that soil solutions at all profiles were supersaturated with calcite.

Fifteen subsurface drains on 23 acres of irrigated agricultural land established by Nevada Agricultural Experiment Station scientists in salinity research at Fallon, Nevada, were sampled in 27 consecutive weeks. The time period and spacing variabilities of electrical conductivity (EC), temperature, pH, dissolved oxygen (DO), and nitrate nitrogen (NO_3-N) were evaluated using time series and geostatistical analyses. Optimum spacings for subsurface drains were compared with the resulting information. Models were established that can be used for forecasting future temporal and spatial values and for determining the transfer function to provide a way to relate water management plans with water quality control.

An improved experimental setup is in use at the University of California-Davis to study dissolution kinetics of carbonate minerals in aqueous systems. Dissolution studies were carried out on a $CaCO_3$ mineral to determine the influence of different surface areas. The same experimental setup was used to study the dissolution kinetics of gypsum and phosphogypsum. Understanding dissolution chemistry of minerals will help develop practices to minimize contributions to salinity in Basin streams.

Monitoring and Evaluation

Monitoring and evaluation (M&E) of the accomplishments of USDA actions in salinity control has a threefold objective. First and most important is to develop information about actual (rather than planned) onfarm effects that have occurred in the area. This information will enable farmers to make informed choices about voluntary implementation of salinity control practices. The information includes cost of practices, changes in water use, labor use, and other farm inputs, and finally, observed changes in crop yield and potential changes in net farm income. The second purpose is to enable SCS to confirm or correct the data used to plan salinity control projects to do a more reliable job of planning other projects. The final purpose is to collect data to be used to evaluate the overall effectiveness and efficiency of USDA salinity control activities from a program standpoint.

Although continuing to be hampered by shortage of staff and funding, SCS M&E activities have moved ahead sharply during

fiscal year 1985. In the Grand Valley Unit in Colorado, 16 automated irrigation M&E sites are now operational, and full-season irrigation data have been collected on 13 fields. Development of the software to process this M&E data proved to be a much larger task than initially estimated, but significant progress was made in 1985 toward developing needed software. Additional programming time will be required in FY 1986.

On the Uinta Basin Unit in Utah, ground water tubes have been installed on 15 farms and efforts will begin to monitor ground water levels using neutron probes. Water inflow and outflow measurements on these farms will be combined with data from six potential evapotranspiration sites to measure deep percolation. The SCS staff is also working with Cooperative Extension in Utah to establish and monitor progress in irrigation water management on four farms.

A plan of study for the economics M&E effort was developed and approved for the Grand Valley Unit and a worksheet to collect farm operations data was developed, field tested, and is ready for the staff to begin collecting data regarding the onfarm effect of salinity reduction activities.

Wildlife habitat M&E efforts have been strongly pushed during FY 1985. Baseline wildlife habitat conditions have been established for 30 additional sites in the Uinta Unit, bringing the total sites evaluated up to 60. Micro-computer programs have also been developed to calculate a habitat suitability index (HSI) for six species for each of the sites. These programs will enable the ready comparison of site habitat condition over time. On the Grand Valley Unit, a Wildlife M&E Annual Report for FY 1984 was prepared. The report gives preliminary data regarding changes that have occurred in wildlife habitat since the inception of the project.

EPA Activities

EPA has responsibility for approving revisions to water quality standards and this year has approved the triennial reviews adopted by several states based on the 1984 Forum standards review. EPA continues to encourage the Basin States to develop and implement state salinity control strategies.

The Forum and EPA policy encouraging the use of poorer quality water or saline water for industrial purposes is being supported primarily through NEPA (National

Environmental Policy Act) review responsibilities. Also, through the NEPA review process, EPA urges the identification of potential salinity impacts resulting from proposed projects, and encourages discussion of mitigation of adverse impacts as required by the Council on Environmental Quality regulations (40 CFR Parts 1500-1508) for implementing NEPA. For example, EPA has commented on potential salinity impacts in reviewing environmental statements for grazing and land management, recreational developments, mining, timber harvesting, oil development, and water development projects.

EPA continues to work with Reclamation on the underground injection control requirements for the Paradox Valley and Dirty Devil River units.

1985 PROGRAM EVALUATION

Data Tables and Cost Effectiveness Summary

The data tables in Appendix A were developed by SCS and Reclamation for use in this evaluation. All costs (October 1984) and interest rates (8 3/4 percent) have been adjusted to the same bases.

The cost effectiveness figures are also included near the end of each set of numbers and are summarized earlier on table 1.

Base Case Conditions/Target Loads

Historical flow and salinity conditions for the Colorado River at Imperial Dam are depicted on figures 5 and 6, respectively. Figure 5 shows that the amount of water that reached Imperial Dam in 1984 was almost 19 million acre-feet. Since the 1966 closure of Glen Canyon Dam, with the exception of 1980, 1983, and 1984, flows at Imperial Dam have fluctuated within the narrow range of 5 to 6 million acre-feet, primarily due to the filling of Lake Powell (1963-1980).

The additional water in 1980, 1983, and 1984 had a dramatic dilution effect on the salinity concentrations at Imperial Dam. Figure 6 shows 670 mg/L in 1984, the lowest level since high flows in 1949 and 1952 reduced the salinity level at Imperial Dam to 639 and 649 mg/L, respectively.

The 1984 salinity reductions at Imperial Dam were due again to excess flow and are expected to have only a temporary inmpact on future salinity projections. Salinity reductions in Lake Powell will have an impact on short-term (ten-year) salinity projections, but will have little impact on long-term projections.

The 1984 flow and salinity conditions represent the initial, or starting, conditions for future CRSS (Colorado River Simulation System) scenarios. Significantly lower TDS at Imperial Dam, full reservoir conditions, and improved salt loading estimates, coupled with lower rate of depletions, have essentially slowed the projected TDS increase at Imperial Dam.

The Base Case condition for the CRSS evaluation assumes that no more funds would be expended on salinity control. Consequently, only the completed salinity control units or

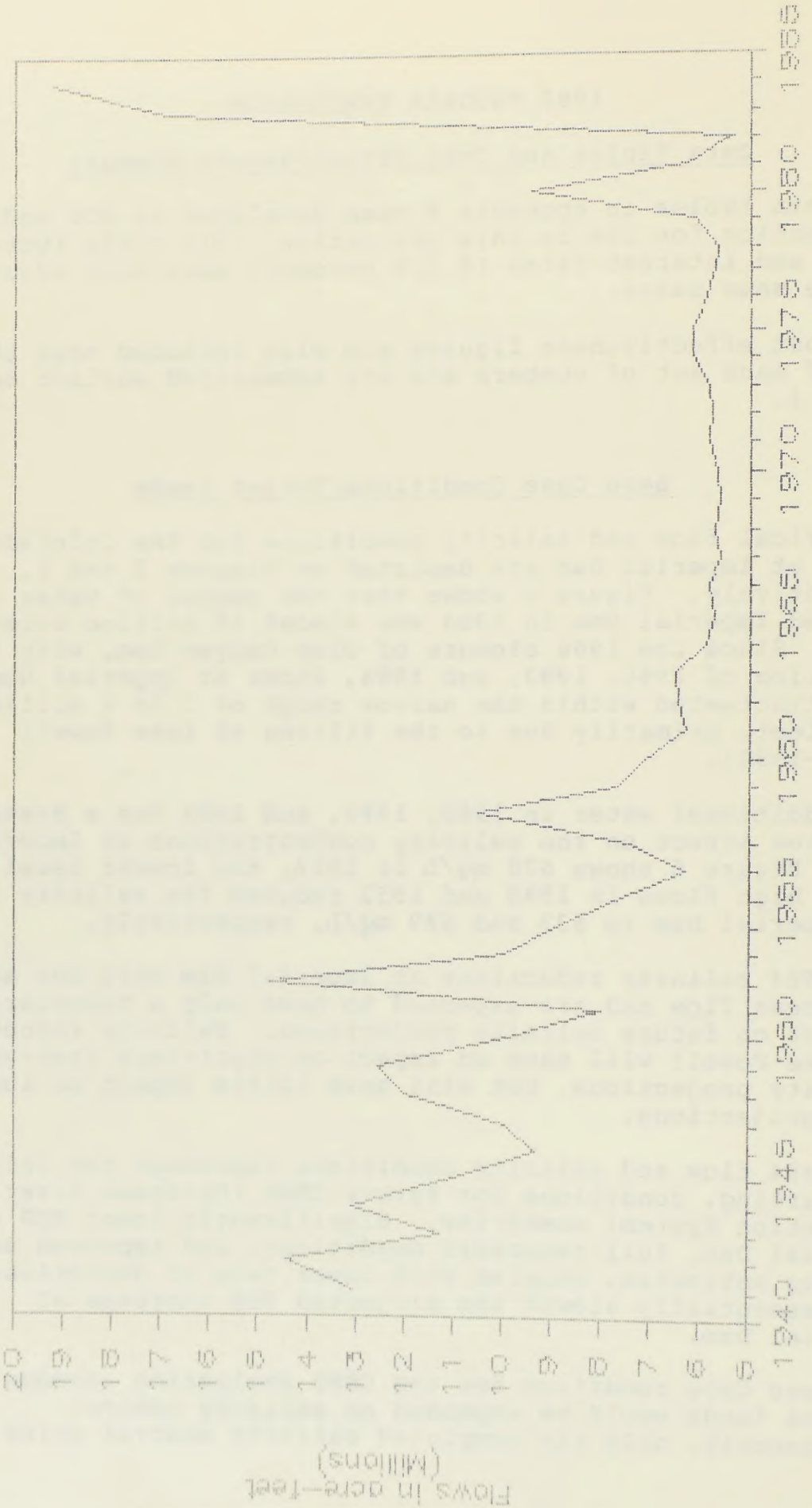


Figure 5. - Historical flows at Imperial Dam.

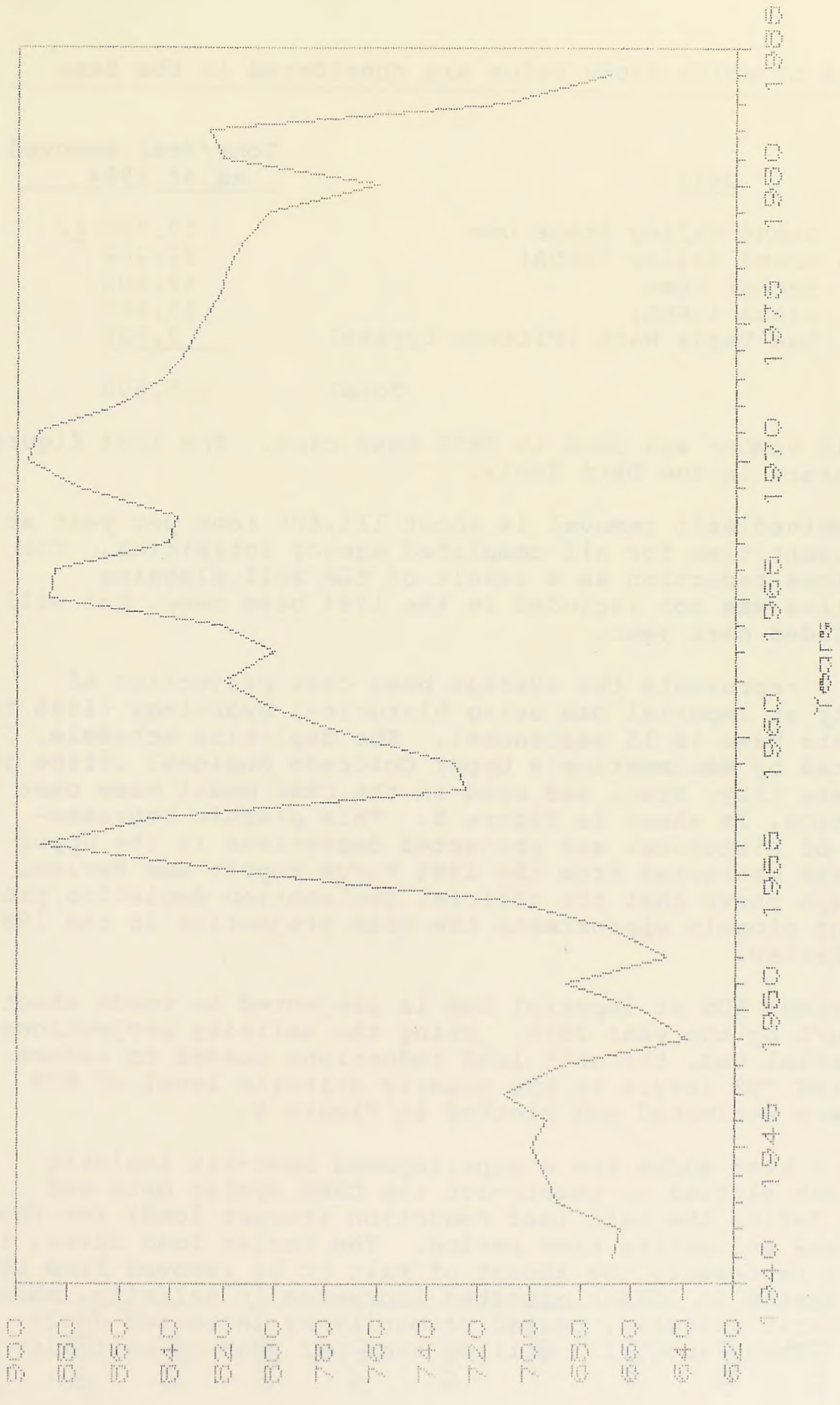


Figure 6. - Historical salinity levels at Imperial Dam.

portions of units shown below are considered in the Base Case:

Unit	Tons/Year Removed as of 1984
1. Grand Valley Stage One	17,700 1/
2. Grand Valley (USDA)	27,300
3. Meeker Dome	48,000
4. Uinta (USDA)	15,600
5. Las Vegas Wash (Pittman bypass)	7,000
Total	115,600

1/ This number was used in CRSS base case. The 1984 figure appears in the Data Table.

The combined salt removal is about 115,600 tons per year at the present time for all completed agency activities. The 7,000 tons reduction as a result of BLM well plugging activities was not included in the 1984 base case, but will be included next year.

Figure 7 represents the average base case projection of salinity at Imperial Dam using historical hydrology (1906 to 1983 data base in 15 sequences). The depletion schedule, estimated by Reclamation's Upper Colorado Regional Office in Salt Lake City, Utah, and used in the CRSS model base case projection, is shown in Figure 8. This graphic representation of historical and projected depletions in the Upper Basin was extracted from the 1984 Forum Report and Review. The graph shows that the official Reclamation depletion projections closely approximate the high projection in the 1984 Forum Review.

The maximum TDS at Imperial Dam is projected to reach about 1005 mg/L by the year 2010. Using the salinity projections at Imperial Dam, the salt load reductions needed to reduce projected TDS levels to the numeric criteria level of 879 mg/L were estimated and plotted in Figure 9.

Figure 9 also shows how a superimposed best-fit logistic curve was plotted to smooth-out the CRSS cyclic data and better define the salt load reduction (target load) for the base case and entire time period. The target load curve, in effect, represents the amount of salt to be removed from the river system to offset expected increases in salinity, above the numeric criteria, caused primarily by increased depletions. Thus, about 1.3 million tons per year of salt must

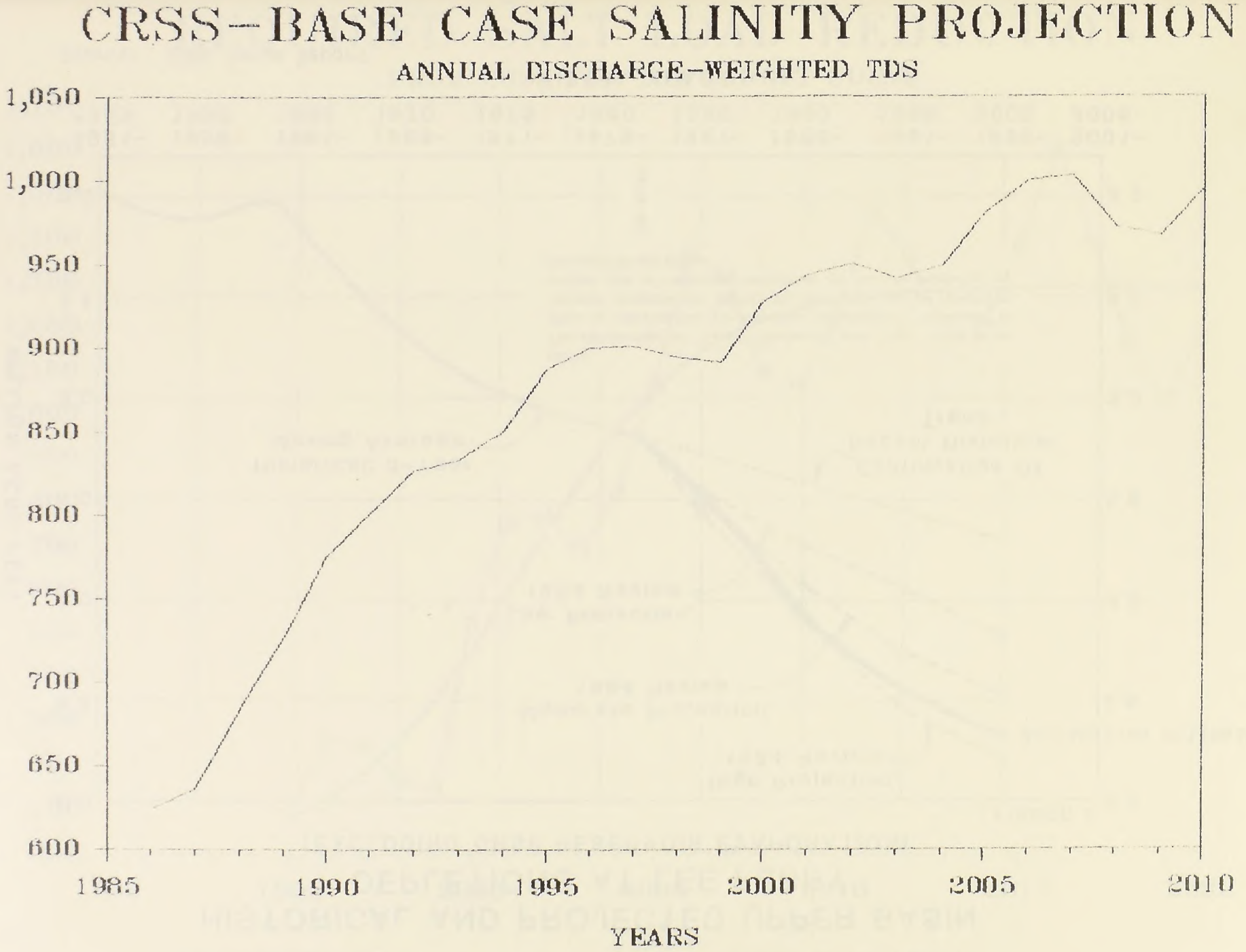
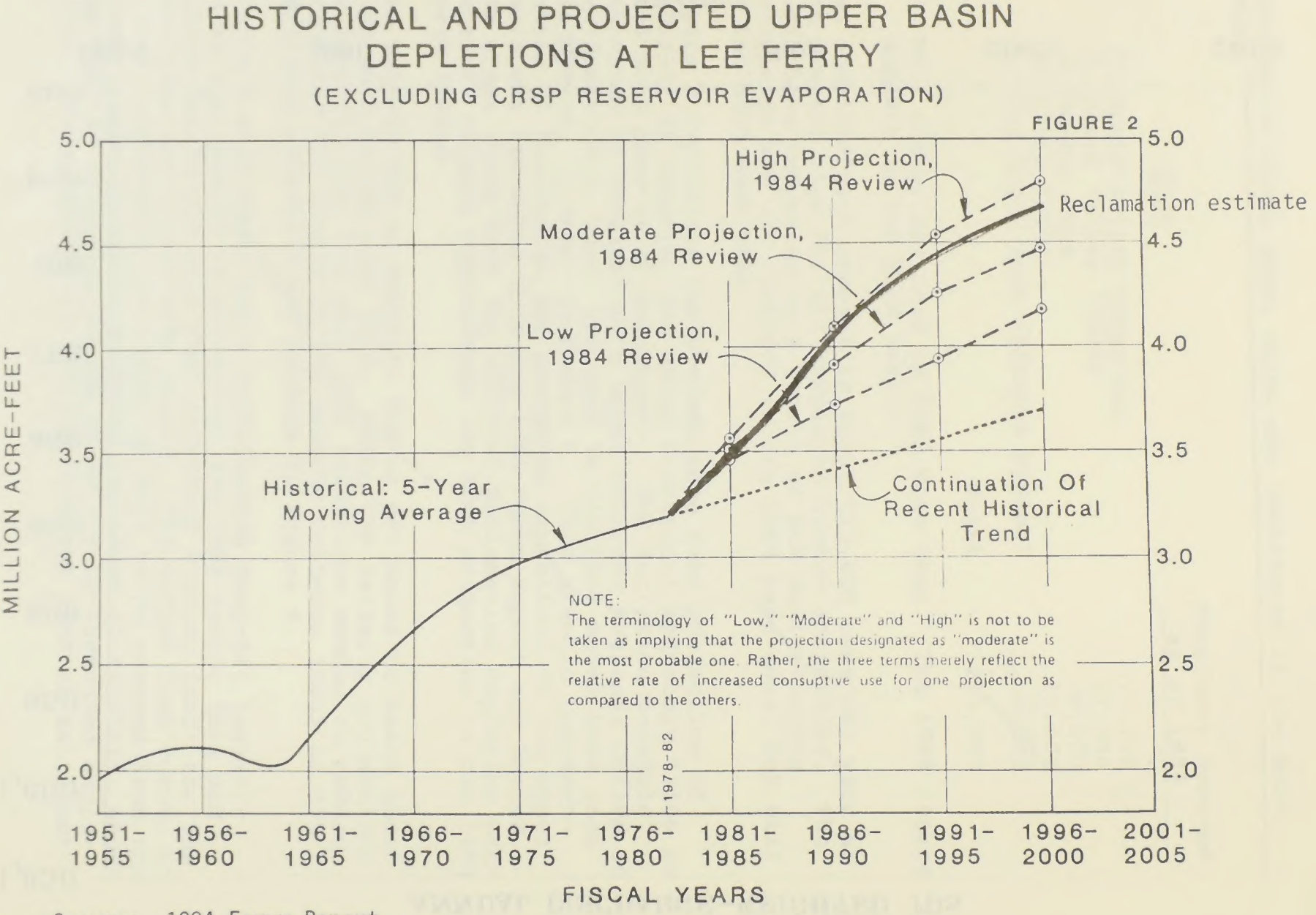


Figure 7. - CRSS-Base Case Salinity Projections; annual discharge-weighted TDS.



Source: 1984 Forum Report

Figure 8. - Historical and Projected Upper Basin Depletions at Lee Ferry, with Reclamation estimate.

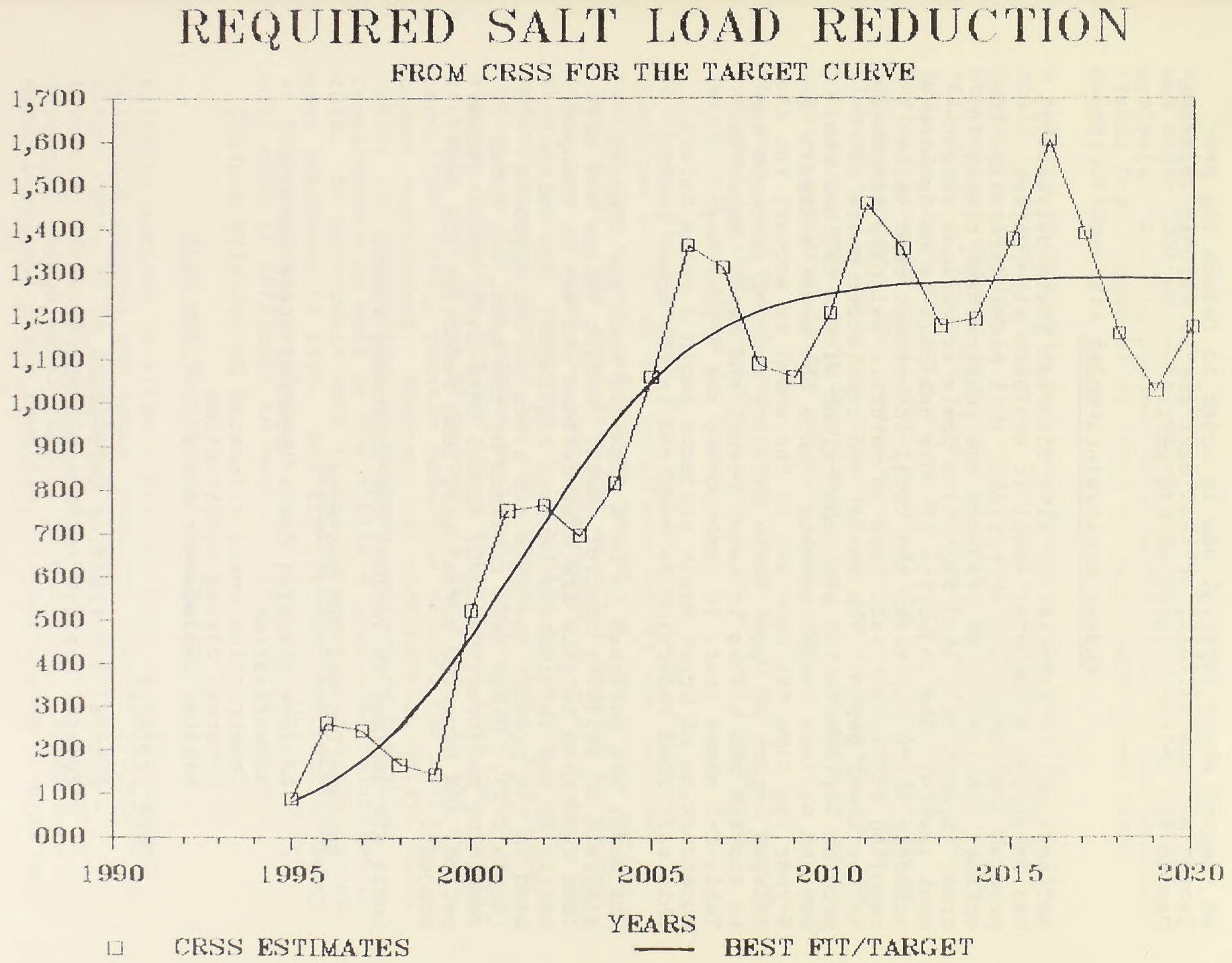


Figure 9. - Required Salt Load Reduction from CRSS for the target curve.

be removed above Imperial Dam in order to reduce the projected maximum salinity of 1005 mg/L TDS in 2010 at Imperial Dam to the criteria level of 879 mg/L.

Budget Constraints Model

Reclamation, in association with Colorado State University, has developed a computer model to evaluate alternative program implementation scenarios. This model determines the optimal combination of projects and construction timing in order to meet salt load reduction goals at various investment levels. The objective of this analysis is to develop a schedule which minimizes the total investment cost while removing sufficient salt load to maintain salinity standards in the Lower Basin. The annual and cumulative costs of program implementation are constrained within defined maximum and minimum budget amounts (hence the model's name). A 4-year lag time has been set in the model to account for the delayed impact of Upper Basin salinity control projects due to storage and mixing in Lakes Powell and Mead. Appendix Table C-1 shows that, to incorporate the 4-year lag, construction of Upper Basin projects begin 4 years before this salt load reduction is required in the Lower Basin.

The model was designed to be a flexible tool for ongoing analysis of salinity control needs. Budget values and salt load reduction targets are user-defined and may be changed easily as new information becomes available. The values used in the present analysis are given in the Appendix (Table C-1). Other data required by the model are total remaining construction cost, annual OM&R cost, construction period, and expected annual salt load reduction for each project.

Costs are defined to include the following items:

Reclamation and BLM projects

- Advance planning costs incurred after project authorization
- Construction costs allocated to salinity control
- Interest during construction
- Habitat replacement costs

USDA projects

- Federal construction cost-share
- Federal habitat replacement costs.

Adequate data are available for nine Reclamation, one BLM, and eight USDA projects, which are included in the present analysis. All the project data is displayed in the Appendix (Table C-2). Several of these projects were given fixed construction-start dates.

A summary of projects and investment levels analyzed in the model is shown in Table 3. The table indicates which projects are included in the various investment or funding assumptions ranging from $301 million to $703 million. The "fixed start" projects shown under each investment level indicate those projects which are "fixed" in terms of current program commitments/constraints for construction or implementation. The remaining projects in the table are flagged to indicate new construction starts and whether the new starts under each investment level are delayed or accelerated compared to the $570 million level.

The salt load reductions, above those obtained to date, are compared against the target reduction at two investment levels and are shown in Figure 10.

In figure 10, the salt load reductions (not including completed units) at two investment levels are compared against the target reductions needed for the entire period (1985-2020). Not only does the selected program investment level have to meet the long-term reduction goal in 2010, but also to provide assurance of remaining above the target reduction requirements for the interim period. The target reductions for the entire period of analysis are based on average hydrology for the basin which means that the numeric criteria will be met 50 percent of the time. In the short term (1985-1995), program reduction exceeds the minimum target requirement. However, any construction delays could reduce the probability of meeting short-term reduction requirements as well as the ultimate salt load reduction in 2010. Of particular note is the increase in program investment estimated in 1990. Any significant construction delay at this critical development point (Paradox Valley Unit) will make it difficult to meet the 1995 target level.

Risk and Uncertainty in Implementation

Salinity control is often viewed as both an enviromental-pollution control and water resources related program. In either case, it is considered a unique undertaking, involving advanced computer modeling and other recently developed ground water control technolgies. Aside from the basic technical risks involved, the basin wide program must

TABLE 3. - BUDGET CONSTRAINTS MODEL IMPLEMENTATION SUMMARY

PROJECTS	FUNDING LEVEL IN MILLIONS OF DOLLARS			
DOI	301	570	664	703
GRAND VALLEY TWO	***	***	***	***
GRAND VALLEY TWO Balance		00	00	00
PARADOX VALLEY	***	***	***	***
DOLORES	***	***	***	***
LOWER GUNNISON I (WW)	***	***	***	***
LOWER GUNNISON I Balance			NEW	NEW
LAS VEGAS WASH I	***	***	***	***
LAS VEGAS WASH II		00	DEL	DEL
DIRTY DEVIL		00	00	00
PRICE/SAN RAFAEL		00	00	00
LOWER VIRGIN RIVER				
UINTA BASIN I		00	00	
SINBAD		00	ACC	
USDA				
GRAND VALLEY	***	***	***	***
UINTA BASIN	***	***	***	***
LOWER GUNNISON		00	DEL	DEL
MOAPA VALLEY		00	DEL	00
VIRGIN VALLEY		00	00	00
McELMO CREEK	***	***	***	***
MANCOS VALLEY		00	DEL	00
BIG SANDY		00	DEL	DEL

KEY> *** = FIXED STARTS
00=SELECTED NEW STARTS
DEL=SELECTED STARTS, DELAYED FROM $570 M LEVEL
ACC=SELECTED STARTS, ACCELERATED FROM $570 M LEVEL
NEW=NEW START, ACCELERATED FROM $570 M LEVEL

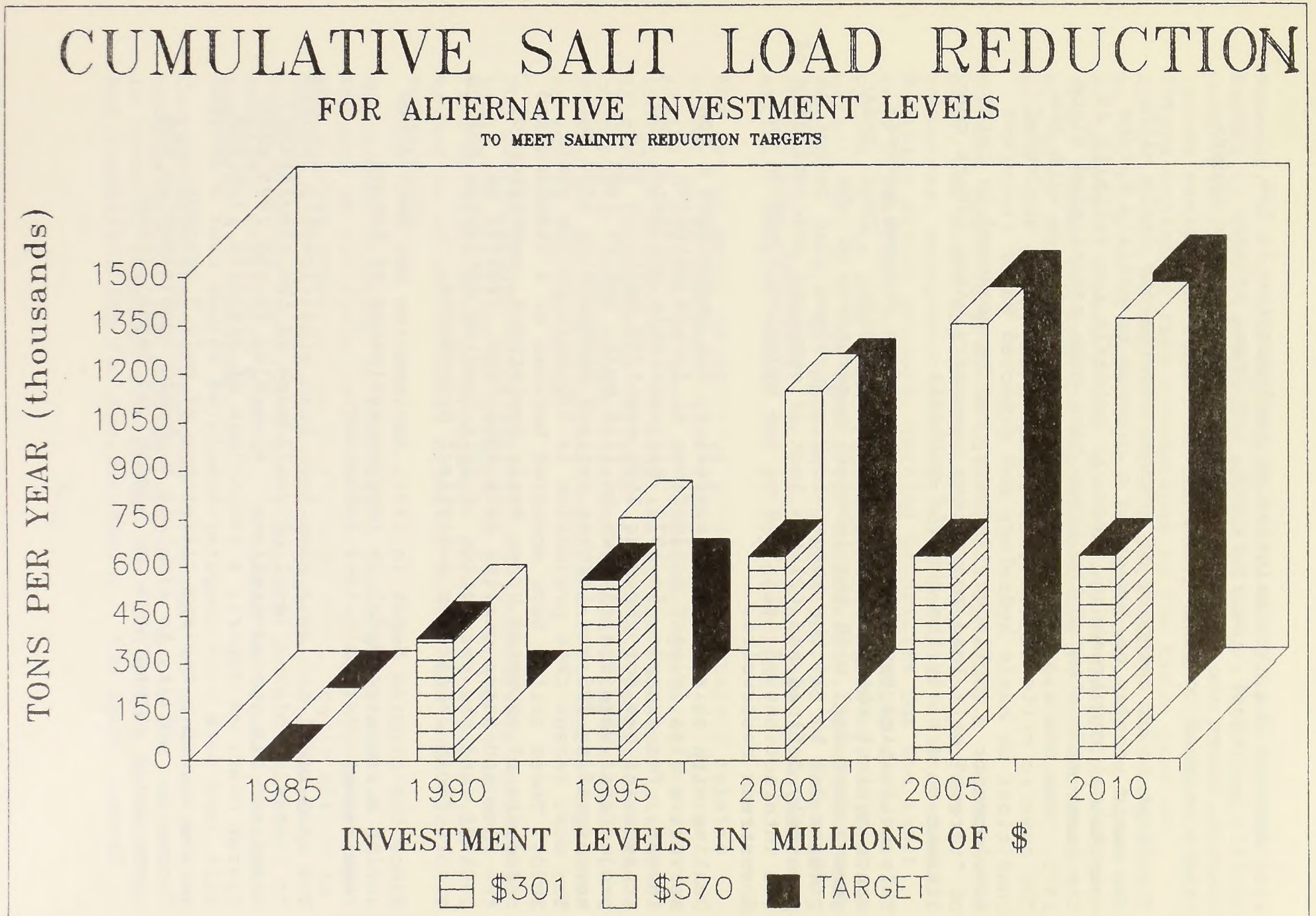


Figure 10. - Cumulative salt load reduction for target and alternative funding levels.

also address the uncertainties of implemention in the social, political, institutional, and legal arenas. Overall, there are two major categories of program uncertainty related to program implementation.

The first major category of program uncertainty deals with the basic problem of designing a program to satisfy future operational requirements. Numeric criteria for salinity in the lower main stem of the river have been established since 1975. The overall program objective is compliance with the TDS numeric criteria at the three stations under projected conditions of basin hydrology and expected water resources development. Compliance, in turn, can be measured in terms of "target" salt load reductions necessary under future conditions to satisfy the numeric criteria.

This evaluation report attempts to measure program performance against the projected target salt loads. Thus, management must deal with the inherent uncertainty of the program due to (1) the target load reductions that cannot be precisely defined and (2) the lack of complete understanding of the interactions of salt load on the hydrologic system and downstream reservoirs.

Dealing with this program uncertainty has encouraged a conservative bias in past projections of future salinity levels. For example, in 1972, Reclamation's projected TDS at Imperial Dam for the year 2000 was 1250 mg/L; in 1974, projections were scaled down to 1116 mg/L; and in 1983, the corresponding TDS was further revised downward to 1010 mg/L. The most recent CRSS projection is 930 mg/L by the year 2000. These shifts have occurred because of a slowdown and reduction of expected Upper Basin depletions, expansion of the flow and water quality data base from 1941-72 to 1906-83, and the correction of salt loading estimates due to errors found in earlier analytical procedures.

Since the program began in 1972, Reclamation has been developing a computer model to improve estimates of future requirements for salt load reduction.

The CRSS model and data base have been significantly refined to instill a higher level of confidence in the simulation model and its representations. According to the 1985 CRSS System Overview Report, a comparison of historic flow and salt load data with computer-simulated values over a 16-year period showed a maximum difference of only 5 percent. Hence, our ability to simulate historic conditions in the river basin strengthens our analytical capabilities.

However, one of the conclusions from the 1984 Evaluation Report is that significant levels of future hydrologic uncertainty remain that cannot be reduced or simplified to reduce management risk. On the other hand, differences in future depletion rate assumptions in the basin have an insignificant effect on salinity projections when compared to the effects of hydrological assumptions. It is important to remember, however, that uncertainty in depletion assumptions themselves remains significant due to basic unknowns of future project funding, political climate, economic growth, and energy development activities.

To meet specific program objectives, minimize a conservative bias, and avoid any unnecessary commitment of program resources, management strategy must consider an incremental decision making process, setting priorities for the short term (1985-1994) and providing for deliberative decision cycles in the long term (beyond 1994). Moreover, to deal effectively with the identified uncertainty, management must regularly review all relevant information, be it measurable, intangible, judgmental, or intuitive, and use it to address salinity program budget and policy decisions.

The second major category of program uncertainty relates primarily to implementation impacts that are unique to salinity control in terms of successful installation and long-term operation. In addition to the technical risks, external requirements for water rights and permits and the concerns of local authorities and entities impose administrative and institutional constraints to timely implementation of program units.

The currently depressed agricultural economy may seriously limit the abilities of farmers to participate in USDA on-farm salinity control programs. Program flexibility is needed to adjust to these types of social and economic constraints.

Management strategy in addressing these uncertainties is focused on verifying selected control technology or process and staging construction to minimize risk. Early action is important in verifying staged construction activities to allow time for innovative modifications and to monitor results. Continuing analysis is needed to identify control tradeoffs and contingencies.

Current management strategies serve well to minimize program uncertainty but the problem remains on how to deal with it in terms of resource allocation, unit selection, scheduling, and quantification for decisionmaking. The study concept

for risk analysis, discussed later, suggests some new approaches to evaluate and quantify some of these uncertainties. During 1986, an attempt will be made to develop a risk and uncertainty methodology that can be better understood and utilized.

Scenario Evaluation

Last year's (1984) evaluation considered five different development scenarios that essentially reflected legislative options and judgmental selections of projects that appeared most promising. New authorizations under Public Law 98-569 and other program changes now demand a more rigorous approach to formulate future scenarios.

This year's strategy stressed use of the budget constraints model, project repayment analysis, and overall program cost effectiveness in generating investment levels for evaluation by CRSS. As emphasized earlier in this report, individual unit cost effectiveness and risk assessment are also considered in the project selection process. The assignment of cost-effectiveness values based on current project data is a relatively straightforward quantification with a summary shown in table 1. Effective evaluation of uncertainty and risk related to project implementation is not so clear or defined. As such, risk assessment for evaluation of investment levels will be deferred until a useful methodology can emerge under present study efforts.

The basic process followed for investment level evaluation is summarized in the following steps:

1. Establish base case conditions for the CRSS model considering pre-1984 basin hydrology, current depletion estimates, and completed salinity control projects.

2. Develop a target-load reduction curve to the year 2010 (see figure 9) reflecting base case conditions with no other salinity control activity under future conditions.

3. Select DOI/USDA projects for fixed construction starts that satisfy current authorizations and other physical constraints.

4. Use the CSU budget constraints model to generate least cost, salt-load reduction investment levels that meet the target load reduction curve to the year 2010. Project selection for the budget model considers:

A. Fixed-start projects as discussed above (with a funding level of $301 million).

B. Other development combinations determined primarily by varying funding levels or total investment costs (ranging from $570 million to $803 million).

C. No fixed predetermined start projects with the project selection determined by minimum investment criteria only.

5. Compare total investment costs and annual costs of the scenarios generated under the budget constraints model against repayment capacity (Lower Basin Development funds).

6. Select investment levels that satisfy repayment capacity, minimum investment, salt-load reduction, and cost effectiveness for CRSS model verification.

7. Verify CRSS TDS projections for selected salinity control scenarios as measured against the base case.

A total of seven investment levels were generated in the budget constraints model. This included the fixed starts, no fixed starts, and investment levels of $570, $608, $664, $703, and $803 million. For clarity, only a few select scenarios (investment levels) are displayed in terms of salt load reduction over the period 1985 to 2010 (see figure 11). In 2010, the $570, $664, and $703 million investment level all come close to satisfying the 1.3 million ton target removed in 2010. However, as seen in figure 10, only the $570 investment level satisfies the salinity reduction requirement at minimum investment.

The projects and mix of projects that make up each investment level are shown in Table 3, Implementation Summary. The table not only shows the fixed start projects but also those that are considered new starts at the $570 million investment level and other starts that are either delayed or accelerated under other investment level assumptions.

Finally, the key results of the repayment analysis for the selected scenario ($570 million investment level) are shown in figure 12. Over the total time period (1985-2010), the total amount of money available in the Lower Colorado River Basin (LCRB) fund is displayed along with expected payouts from the fund to meet capital, O&M, and interest requirements. Also shown are the payouts under a 4.5 percent inflation rate applied to payouts over the entire time

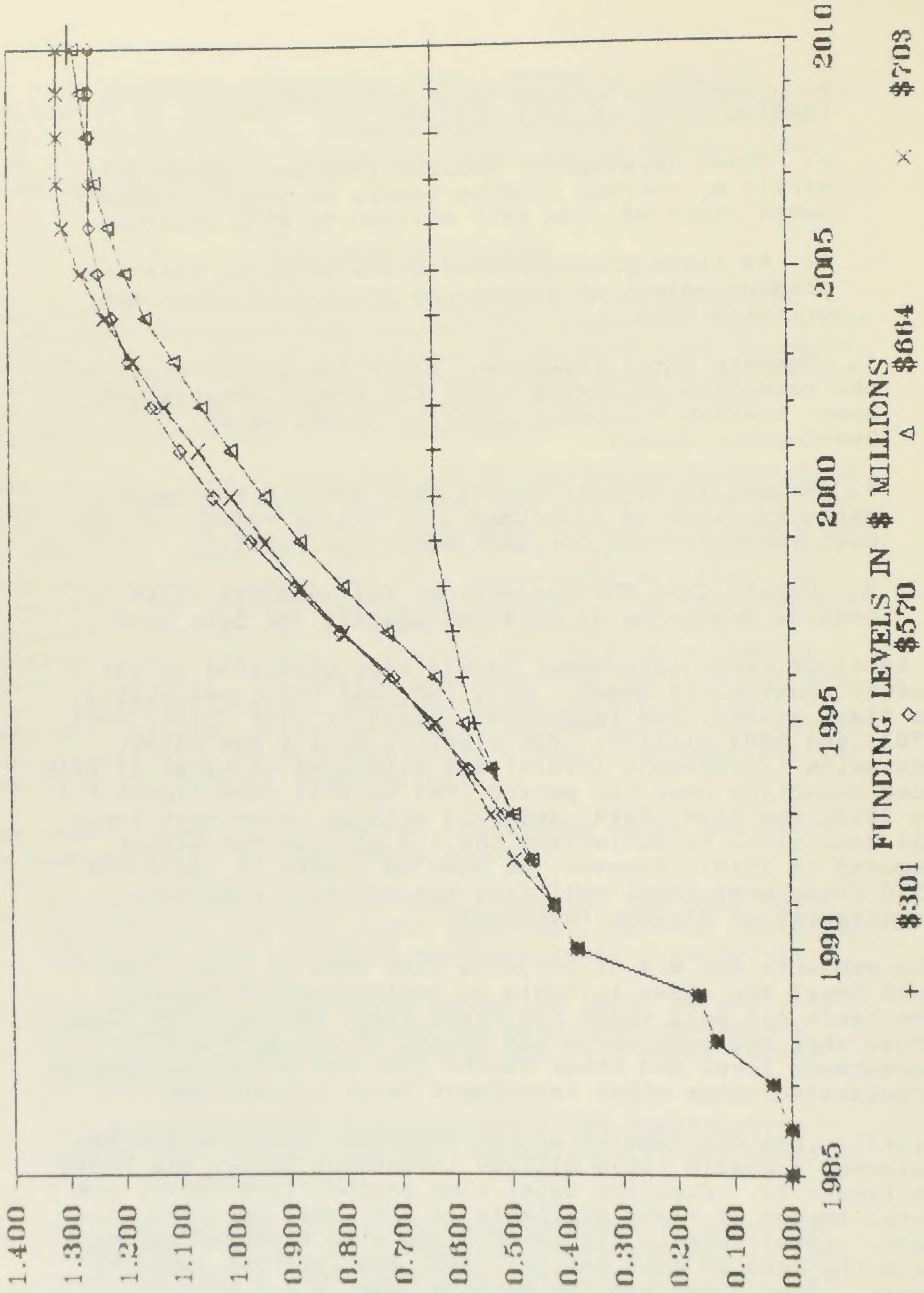


Figure 11. - Cumulative salt load reduction for alternative funding levels.

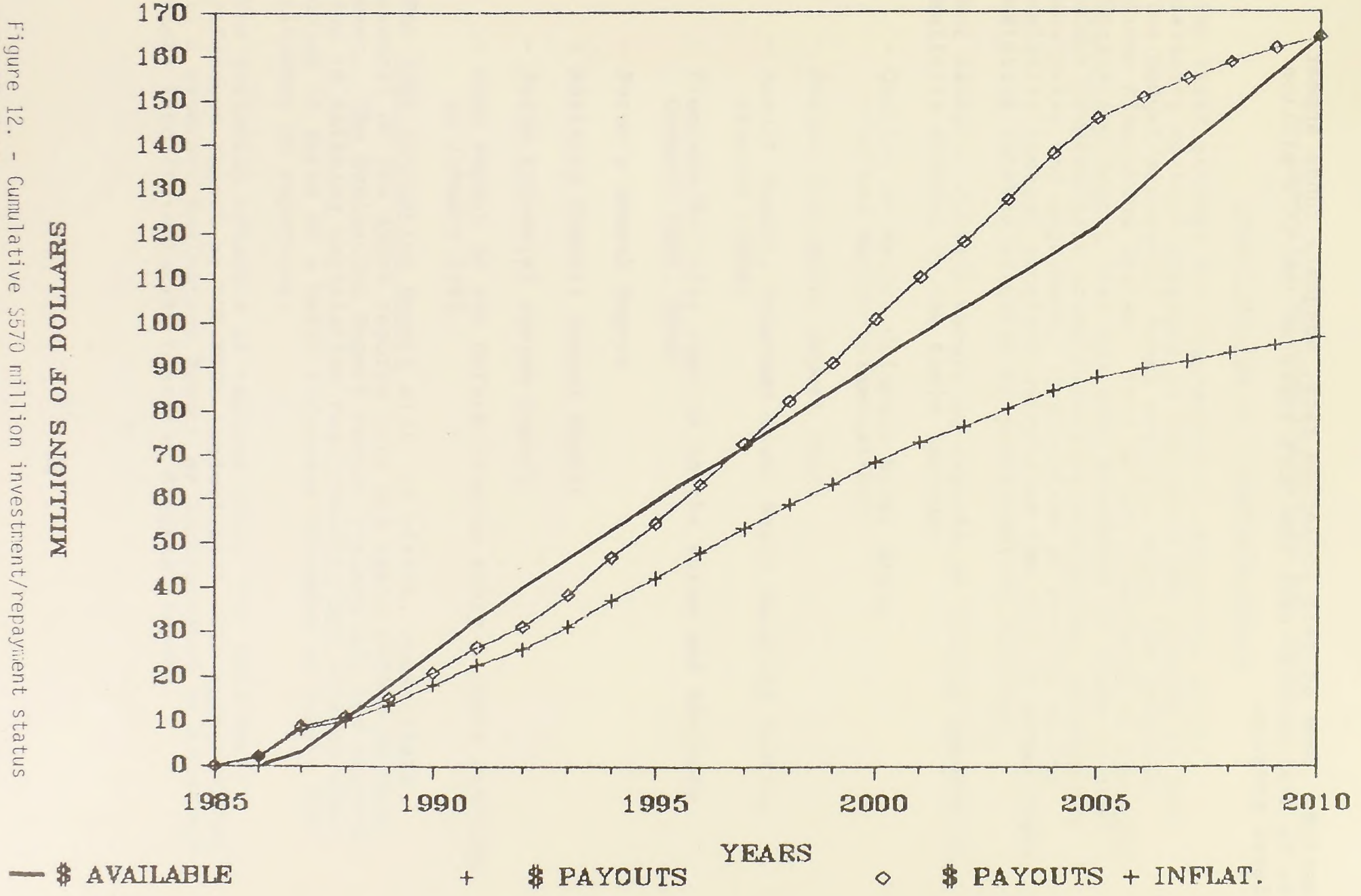


Figure 12. - Cumulative $570 million investment/repayment status of LCRB Fund.

period. Even at this inflation rate, adequate funds appear to be available to meet the LCRB share of the $570 million level program.

1985-1986 PROGRAM ACTIVITIES AND NEEDS

Consolidation of Reports/Schedule

The first attempt for comprehensive evaluation of all salinity control programs in the basin was started in 1983 for budget/management-level analysis using the Colorado River Simulation System. This effort culminated in the 1984 Evaluation Report that has been broadened in scope to consider program/unit prioritization, scheduling, uncertainty analysis, and repayment. Duplication of reports on the salinity control programs underlined the need to consolidate existing reports prepared by participating entities.

For example, current recurring reports on various aspects of salinity control in the basin include:

- Quality of Water, Colorado River Basin Progress Report (Biennial-DOI)
- Annual Evaluation Report (DOI)
- Annual Report, Colorado River Basin Salinity Control Program (USDA)
- Progress/Activity reports to the Forum and Advisory Council (DOI, USDA)
- Forum's Annual Report
- Advisory Council Annual Report
- Forum triennial review report
- USDA Report on the Onfarm Program every 5 years starting in January 1988.

The 1985 Evaluation Report will, in effect, consolidate several of the above reports into one basic reference document. The Evaluation Report cannot replace all the reports due to existing legislative requirements, but will be scheduled to serve as a basic reference document to insure consistency of reporting.

The following schedule of reports shows that this basic reference report by DOI/USDA (underlined) will appear either in a separate Evaluation Report or incorporated on alternate years into the existing biennial Progress Report.

November 1985 Evaluation Report
January 1986 Forum's Annual Report
February 1986 Advisory Council Annual Report

December 1986 Quality of Water - Progress Report No. 13
January 1987 Forum's Triennial Review
February 1987 Advisory Council Annual Report

November 1987 Evaluation Report
January 1988 Forum's Annual Report
February 1988 Advisory Council Annual Report

Through this consolidation of reports and judicious scheduling, duplication of effort will be avoided and a simple, comprehensive reference document will emerge to streamline interagency program evaluation.

Interagency Program Coordination

In response to concerns raised by the Colorado River Basin Salinity Control Forum and the mandate contained in the amendatory legislation for the Colorado River Salinity Control Program, the Department of the Interior and the Department of Agriculture formed a TPCC (Technical Policy Coordination Committee) in 1985 to improve coordination of the salinity control programs. The committee is comprised of representatives of the Bureau of Reclamation and the Soil Conservation Service.

One of the most significant accomplishments during FY 85 was the establishment of a USDA Basin Coordinator position to assist in carrying out the Colorado River Salinity Program. The position is responsible for coordination and evaluation of USDA salinity control activities in the Basin. The Coordinator, headquartered at the Bureau of Reclamation's Colorado River Water Quality Office in Denver, Colorado, is the primary point of contact with the Bureau of Reclamation and USDA agencies. He is also responsible for providing salinity control program assistance for the seven Basin State Conservationists of SCS; Director, WNTC (West National Technical Center); and other Federal, State, and local entities and organizations.

Issues addressed and resolved by the TPCC during the past year include:

1. The 1985 Evaluation Report process.

2. Development of a Data Table summarizing the salinity program activities being conducted by both

Departments with common cost estimates (October 1984) and interest rates (8 3/8 percent).

3. Development of common cost-effectiveness criteria to enable direct comparison of programs developed by the two Departments.

4. Development of a Department of Agriculture accounting procedure for inclusion of their cost-share component in the Basin Fund repayment process.

5. Development of common repayment criteria for use in the analysis of Basin Fund repayment capability.

6. Development of a common methodology for assessing a project prioritization schedule for the salinity control program.

7. Development of a procedure to address combining Department of Agriculture and Department of the Interior programs where the combined effort results in greater overall cost-effectiveness than the individual programs.

8. Agreement on joint interagency reporting processes.

Items to address during the upcoming year include:

1. Coordination of the basinwide and individual project monitoring and evaluation plans.

2. Coordination of Reclamation off-farm planning, design, and implementation with SCS planning, design, and implementation of onfarm systems improvement.

3. Agreement on a joint salt load reporting process in the Grand Valley.

Risk Analysis for Evaluating and Ranking Salinity Control Projects

The salinity control projects proposed by DOI or the USDA all hold potential for reducing the salt load in the Colorado River. Not all the projects will be needed to meet program goals. Prioritization of projects for implementation could be based solely upon the cost effectiveness of each project--the cost for removing a given amount of salt from the river ($/ton). However, the projects vary not only in their performance (tons of salt removed) and cost, but

also in the accuracy or certainty with which their cost and performance can be predicted. While some projects hold the potential for very attractive cost effectiveness, they may, when implemented, require much greater investments than anticipated, or may not remove as much salt as predicted. This uncertainty may result from the use of new, unproven technologies, or the lack of complete technical information on a project's geologic, hydrologic, or engineering aspects. It also may be uncertain that a project can even be implemented, due to social, legal, political, or fiscal unacceptability.

Thus, when projects are ranked in order of priority for implementation, it is important to consider not only their potential cost effectiveness, but also the chances that the expected cost effectiveness will in fact be realized. It may be prudent to give higher priority to projects that, while not having the highest performance potential, utilize proven technologies with known costs, and have good social and political acceptability. However, it is noted that some of the most cost-effective projects may use high-risk technologies. Hence, it is desirable to expand project evaluation beyond the quantified data presented in the table or ledgers.

One means for considering a project's risks when setting priorities is to conduct an "expected value analysis" or risk analysis. The aim of this analysis is to estimate the probability that a project will in fact achieve a predicted level of performance. These probabilities are combined with the predicted performance and cost to derive a composite project ranking. This value reflects both the predictions of a project's performance and the risks involved. If two projects have the same predicted costs and performance, the project with fewer risks will score higher on an expected ranking scale.

The study to set up the evaluation framework will be conducted primarily under contract in 1986 and will be used in the 1986 evaluation process. A consultant in decision analysis will develop a study plan in conjunction with Reclamation staff. The consultant will meet with experts to define the important risk factors and to collect and develop probability data. The consultant will develop the expected value model and generate rankings of the projects. Sensitivity analyses will be conducted to determine which risks contribute most to the uncertainties associated with each project.

Economic Update

While the concept of cost-effectiveness allows for effective project selection and order of implementation, the determination of the overall benefits or damages avoided by program implementation remains an important aspect. Estimates of avoided damages are addressed formally in planning reports prepared under Principles and Guidelines and are frequently used in public documents. A preliminary analysis of economic impacts of salinity was initiated in 1976, resulting in a 1980 report entitled Economic Impacts on Agricultural, Municipal, and Industrial Users by Messrs. Kleiman and Brown. Since this earlier work, there have been many changes in water use, treatment, equipment costs, etc., that affect present and future salinity damage levels.

An update of this previous work is needed to provide a better estimate of present and future salinity damages under current water use scenarios and economic conditions. It will also serve to revise and clarify earlier investigations and address remaining questions and issues of potential economic impact. A final report will be prepared to incorporate all findings and summarize new estimates in graphical format as well as in computer code.

This update will involve both in-house and contract studies funded by Reclamation. Efforts to initiate such a study started in 1985 with completion of a final report expected in late 1986 by an as yet unknown contractor.

Onfarm Economics - Salinity Benefits, Vista Basin

USBR will be reevaluating and updating the salinity impacts and economic aspects of the Vista Basin salinity project. The changes in the actual implementation differs from those proposed in the published report. This affects the ultimate salinity reduction impacts. This also affects the legislatively authorized cost-share levels that are determined by the ratio of onfarm effects and offsite salinity benefits.

SCS proposes to submit this updated information and analyses through the interagency review process. This will be a part of the continuing dialogue between SCS and Reclamation as a matter of technical policy coordination.

Forum NPDES Permits Policy

A major program activity of the seven Basin States is the placing of effluent limitations on industrial and municipal

discharges in the Basin, principally under the NPDES (National Pollution Discharge Elimination System) permit program.

Currently, more than 600 industrial and municipal permits exist in the Basin. The program was authorized by the Federal Clean Water Act. EPA can administer the program or delegate the authority to an individual State if the State so desires and has adequate laws to administer and enforce the program. Some programs in the basin are administered by EPA, while others are administered by individual States. A permit sets discharge limitations and often requires a monitoring program. Because of the nature of the stream system and the water use pattern, the number of NPDES permits is not spread equally among the states. Currently, Arizona has 59 permits (above Imperial Dam), California 1, Colorado 357, Nevada 5, New Mexico 31, Utah 99, and Wyoming 53.

A major effort this year was collecting and summarizing data relating to the permits. A data base has been set up that contains a listing of all permits in the basin, the effluent limitations set in the permits, the actual effluent data, and other vital information concerning the permit.

The Forum is currently analyzing the significance of saline discharges associated with these permits. It is expected that this new data base can be used to better understand the location and importance of various man-induced discharges; and the data will assist the States to collectively address the salinity problems of the Basin. More comprehensive information on the NPDES program is available in the Forum's annual report.

Nonpoint Source (208) Planning

A second major program activity entered into by the Basin States is planning for the control of nonpoint source pollutants. The Federal Clean Water Act authorized, under section 208, the preparation of Water Quality Management Plans. All of the States prepared plans that were, for the most part, funded by the Federal Government for addressing erosion control, nonpoint source salinity control and improvements in irrigation systems, and irrigation water management problems.

Funds for 208 planning are no longer available from Federal sources, however, some Federal planning funds have been made available and have been programmed by some of the Basin

States for use in updating the 208 plans. Many of the nonpoint sources are being reexamined and all of the plans endorse the salinity control policies of the Forum.

The States have prepared an evaluation of their needs for further planning and program implementation with respect to nonpoint source discharges. The 50 states collectively have taken this information and, through a national association of state water pollution control officials, presented to the Congress the collective needs in this area. The States have been supportive of the enactment of new legislation. Both the House and the Senate this year passed legislation that would give new authority and new funding to 208 planning. At the time of this publication, it is anticipated that a conference committee will agree upon legislation that will provide for the disbursement of additional funds to the States for these 208 efforts. It is further anticipated that the Basin States will use some of the funds allocated by this program to further analyze and, if the authorization and funding allow, implement programs for salinity control in the Colorado River Basin.

ACP vs CRSC Program Staffing and Funding

Since 1979, USDA implementation of the Grand Valley and Uinta Basin units has been accomplished via funds reprogramed from other USDA program activities--specifically, ACP funds from ASCS for cost sharing and conservation operations funds from SCS for technical assistance. Although new program authorities provide for direct funding of the onfarm salinity program, the failure to fund these authorities has resulted in a significant and growing disparity between the amount of work that has been planned and committed with landowners, and the amount of limited technical assistance available to help landowners install it. The USDA agencies, in consultation with the Basin States, propose to undertake indepth analyses of the short and long run staffing and funding impacts in an effort to obtain relief from this situation.

APPENDIX A

DATA TABLES

DT:CRHOIP DATA TABLE - JUNE 21, 1985 OCTOBER 1, 1985 last entry

	BLM Sinbad Valley	BR Meeker Dome	BR Grand Valley Stage One
	COLORADO	COLORADO	COLORADO
Date of Estimate:	1/82	Completed	Completed
Interest Rate:	7.63		
Estimate Adjustment for 10/84:	108.69%		
10\84 Interest Rate	8.13		
IDC Adjustment for 10/84:	6.55%		
Project Area			
1. Irrigated Area (total acres)			6,000
2. Potential Participants:			
a. Individuals (number)			
b. Groups (number)			
3. Canals (total miles)			
4. Laterals (total miles)			
5. Point Sources (number)	1	3	
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)			
2. Canals (tons/year)			
3. Laterals (tons/year)			
4. Point Sources (tons/year)	8,938	52,000	
5. Other (tons/year)			
Implementation Plan			
1. Construction Start (year)	1989		1988
2. Construction Period (years)	3		3
3. Expected Participants:			
a. Individuals (number)			
b. Groups (number)			
4. On-farm Practices:			
a. Treated Area (acres)			
b. Land Leveling (acres)			
c. Sprinkler Systems (acres)			
d. Farm Ditches/Pipelines (miles)			
5. Canal Lining (miles)			6.7@
6. Lateral Lining (miles)			
7. Pipe Laterals (miles)			29.7
8. Winter Water Systems (miles)			
9. Collection Features (type)	low dam		
10. Delivery Systems (type)	pipeline		
11. Disposal Facilities (type)	deep well inj	well plugs	
12. Habitat Replacement (acres)			
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			19,900
d. Point Sources (tons/year)		19,000	
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)	7,470		
e. Other (tons/year)			

Data Source: 9/82 BLM Rpt 7/85 Clc Rpt 2/85 Supp DPR

		BLM Sinbad Valley	BR Meeker Dome	BR Grand Valley Stage One
		COLORADO	COLORADO	COLORADO
Economic and Financial Analyses				
	Department of the Interior:			
1.	Plan Formulation Costs		3,118,000	
2.	Nonsalinity Planning Costs			
3.	Advance Planning Costs:			
	a. Prior to Authorization			25,000
	b. After Authorization	500,000		
4.	Nonsalinity Design Costs			
5.	Salinity Const. Costs To Date			27,744,000
6.	Balance Salinity Const. Costs	7,272,638		
7.	Nonsalinity Construction Costs			
8.	Habitat Replacement Costs			
9.	Salinity IDC:			
	a. Economic	304,411		1,112,000
	b. Financial			
10.	Nonsalinity IDC			
	a. Economic			
	b. Financial			
11.	Salinity OM&R Costs w/o Power	54,346		(6,000)
12.	Nonsalinity OM&R w/o Power			
13.	Economic Cost of Power			
14.	Financial Cost of Power	9,456		
15.	Salinity M & E Costs			
16.	Nonsalinity M & E Costs			
	Department of Agriculture:			
1.	Technical Assistance Costs			
2.	M & E Costs			
3.	Information and Education Costs			
4.	Federal Cost-share Obligations			
5.	Federal Const. Cost-share To Date			
6.	Balance Federal Const. Cost-share			
7.	Local Construction Cost-share			
8.	Percent Federal Cost-share:			
9.	Federal Habitat Costs			
10.	Local Habitat Costs			
11.	Other Local Costs			
12.	Local O&M Costs			
13.	Annual Value of Replacement Costs			
14.	Federal IDC			
	Cost Effectiveness:			
1.	Total Salinity Construction Costs	7,272,638	3,118,000	27,744,000
2.	Advance Planning Costs	500,000		
3.	Habitat Replacement Costs			
4.	IDC (Economic)	304,411		1,112,000
5.	Investment Cost	8,077,050	3,118,000	28,856,000
6.	Annual Equivalent Investment Costs	688,972	265,965	2,461,417
7.	Annual Salinity OM&R Costs	54,346		-6000
8.	Annual Economic Cost of Power	9,456		
9.	Annual M & E Costs			
10.	Annual Habitat OM&R Costs			
11.	Annual Salinity Costs	752,775	265,965	2,455,417
12.	Tons of Salt Removed Annually	7,470	19,000	19,900
13.	Cost Effectiveness - $/ton	101	14	123

	BR Grand Valley Stage Two	BR Grand Valley Stage Two Balance	USDA Grand Valley
	COLORADO	COLORADO	COLORADO
Date of Estimate:	1/84	1/84	10/79
Interest Rate:	8.13%	8.13%	7.00%
Estimate Adjustment for 10/84:	101.39%	101.39%	
10\84 Interest Rate	8.38%	8.38%	8.38%
IDC Adjustment for 10/84:	3.00%	3.00%	
Project Area			
1. Irrigated Area (total acres)	45,270	8,730	66,000
2. Potential Participants:			
a. Individuals (number)			920
b. Groups (number)			250
3. Canals (total miles)			
4. Laterals (total miles)			190
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)			300,000
2. Canals (tons/year)			
3. Laterals (tons/year)			100,000
4. Point Sources (tons/year)			
5. Other (tons/year)			
Implementation Plan			
1. Construction Start (year)	1986	1996	1979
2. Construction Period (years)	14	9	15
3. Expected Participants:			
a. Individuals (number)			920
b. Groups (number)			250
4. On-farm Practices:			
a. Treated Area (acres)			53,000
b. Land Leveling (acres)			16,900
c. Sprinkler Systems (acres)			800
d. Farm Ditches/Pipelines (miles)			1,790
5. Canal Lining (miles)	31.86	6.14	
6. Lateral Lining (miles)	258.20	49.80	15
7. Pipe Laterals (miles)			175
8. Winter Water Systems (miles)			
9. Collection Features (type)			
10. Delivery Systems (type)			
11. Disposal Facilities (type)			
12. Habitat Replacement (acres)			1,200
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			17,000
c. Laterals (tons/year)			
d. Point Sources (tons/year)			10,300
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)			
b. Canals (tons/year)	120,300	23,200	113,000
c. Laterals (tons/year)			
d. Point Sources (tons/year)			89,700
e. Other (tons/year)			
Data Source:	2/85 Supp DPR	2/85 Supp DPR	SCS/CO

	BR Grand Valley Stage Two	BR Grand Valley Stage Two Balance	USDA Grand Valley
	COLORADO	COLORADO	COLORADO
Economic and Financial Analyses			
Department of the Interior:			
1. Plan Formulation Costs	170,002	104,998	
2. Nonsalinity Planning Costs			
3. Advance Planning Costs:			
a. Prior to Authorization			
b. After Authorization			
4. Nonsalinity Design Costs			
5. Salinity Const. Costs To Date			
6. Balance Salinity Const. Costs	120,391,101	74,356,677	
7. Nonsalinity Construction Costs			
8. Habitat Replacement Costs			
9. Salinity IDC:			
a. Economic	5,010,759	3,094,775	
b. Financial			
10. Nonsalinity IDC			
a. Economic			
b. Financial			
11. Salinity OM&R Costs w/o Power	448,771	277,173	
12. Nonsalinity OM&R w/o Power			
13. Economic Cost of Power			
14. Financial Cost of Power			
15. Salinity M & E Costs			
16. Nonsalinity M & E Costs			
Department of Agriculture:			
1. Technical Assistance Costs			14,500,000
2. M & E Costs			3,260,000
3. Information and Education Costs			1,600,000
4. Federal Cost-share Obligations			35,500,000
5. Federal Const. Cost-share To Date			6,000,000
6. Balance Federal Const. Cost-share			29,500,000
7. Local Construction Cost-share			15,200,000
8. Percent Federal Cost-share:			70
9. Federal Habitat Costs			
10. Local Habitat Costs			
11. Other Local Costs			
12. Local O&M Costs			267,000
13. Annual Value of Replacement Costs			579,000
14. Federal IDC			
Cost Effectiveness:			
1. Total Salinity Construction Costs	120,391,101	74,356,677	51,600,000
2. Advance Planning Costs	0	0	
3. Habitat Replacement Costs	0	0	0
4. IDC (Economic)	5,010,759	3,094,775	0
5. Investment Cost	125,401,860	77,451,452	51,600,000
6. Annual Equivalent Investment Costs	10,696,779	6,606,609	4,401,480
7. Annual Salinity OM&R Costs	448,771	277,173	579,000
8. Annual Economic Cost of Power			
9. Annual M & E Costs			278,078
10. Annual Habitat OM&R Costs			
11. Annual Salinity Costs	11,145,550	6,883,782	5,258,558
12. Tons of Salt Removed Annually	120,300	23,200	230,000
13. Cost Effectiveness - $/ton	93	297	23

	BR Paradox	BR Lower Gunnison Stage One Winter Water	BR Lower Gunnison Stage One Deferred
	COLORADO	COLORADO	COLORADO
Date of Estimate:	10/85	1/85	1/85
Interest Rate:	8.63%	8.62%	8.62%
Estimate Adjustment for 10/84:	100.61%	99.32%	99.32%
10\84 Interest Rate	8.38%	8.38%	8.38%
IDC Adjustment for 10/84:	-2.90%	-2.78%	-2.78%
Project Area			
1. Irrigated Area (total acres)			
2. Potential Participants:			
a. Individuals (number)			
b. Groups (number)			
3. Canals (total miles)			
4. Laterals (total miles)			
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)			
2. Canals (tons/year)			
3. Laterals (tons/year)			
4. Point Sources (tons/year)	205,000		
5. Other (tons/year)		78,550	
Implementation Plan			
1. Construction Start (year)	1986	1987	1990
2. Construction Period (years)	4	1	6
3. Expected Participants:			
a. Individuals (number)			
b. Groups (number)			
4. On-farm Practices:			
a. Treated Area (acres)			
b. Land Leveling (acres)			
c. Sprinkler Systems (acres)			
d. Farm Ditches/Pipelines (miles)			
5. Canal Lining (miles)			58.90
6. Lateral Lining (miles)			195.40
7. Pipe Laterals (miles)			
8. Winter Water Systems (miles)			
9. Collection Features (type)	shallow wells		
10. Delivery Systems (type)	pipeline		
11. Disposal Facilities (type)	deep well inj		
12. Habitat Replacement (acres)			2,100
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)	180,000	74,300	66,300
e. Other (tons/year)			
Data Source:	MPO/PF-65	1/84 FR/FES	1/84 FR/FES

		BR Paradox	BR Lower Gunnison Stage One Winter Water	BR Lower Gunnison Stage One Deferred
		COLORADO	COLORADO	COLORADO
Economic and Financial Analyses				
	Department of the Interior:			
1.	Plan Formulation Costs			
2.	Nonsalinity Planning Costs			
3.	Advance Planning Costs:			
	a. Prior to Authorization			
	b. After Authorization			
4.	Nonsalinity Design Costs			
5.	Salinity Const. Costs To Date	13,390,382		
6.	Balance Salinity Const. Costs	49,491,752	14,900,939	142,100,034
7.	Nonsalinity Construction Costs			
8.	Habitat Replacement Costs			
9.	Salinity IDC:			
	a. Economic			
	b. Financial			
10.	Nonsalinity IDC			
	a. Economic			
	b. Financial			
11.	Salinity OM&R Costs w/o Power	170,037		
12.	Nonsalinity OM&R w/o Power			
13.	Economic Cost of Power	150,920		
14.	Financial Cost of Power			
15.	Salinity M & E Costs			
16.	Nonsalinity M & E Costs			
	Department of Agriculture:			
1.	Technical Assistance Costs			
2.	M & E Costs			
3.	Information and Education Costs			
4.	Federal Cost-share Obligations			
5.	Federal Const. Cost-share To Date			
6.	Balance Federal Const. Cost-share			
7.	Local Construction Cost-share			
8.	Percent Federal Cost-share:			
9.	Federal Habitat Costs			
10.	Local Habitat Costs			
11.	Other Local Costs			
12.	Local O&M Costs			
13.	Annual Value of Replacement Costs			
14.	Federal IDC			
	Cost Effectiveness:			
1.	Total Salinity Construction Costs	62,882,134	14,900,939	142,100,034
2.	Advance Planning Costs			
3.	Habitat Replacement Costs			
4.	IDC (Economic)			
5.	Investment Costs	62,882,134	14,900,939	142,100,034
6.	Annual Equivalent Investment Costs	5,363,846	1,271,050	12,121,133
7.	Annual Salinity OM&R Costs	170,037		
8.	Annual Economic Cost of Power	150,920		
9.	Annual M & E Costs			
10.	Annual Habitat OM&R Costs			
11.	Annual Salinity Costs	5,684,803	1,271,050	12,121,133
12.	Tons of Salt Removed Annually	180,000	74,300	66,300
13.	Cost Effectiveness - $/ton	32	17	183

	BR Lower Gunnison North Fork	USDA Lower Gunnison	BR Dolores
	COLORADO	COLORADO	COLORADO
Date of Estimate:		7/80	10/85
Interest Rate:		7.38%	8.63%
Estimate Adjustment for 10/84:			97.28%
10\84 Interest Rate		8.38%	8.38%
IDC Adjustment for 10/84:			-2.98%
Project Area			
1. Irrigated Area (total acres)		171,000	
2. Potential Participants:			
a. Individuals (number)		2,000	
b. Groups (number)			
3. Canals (total miles)		140	
4. Laterals (total miles)		345	
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)		440,000	
2. Canals (tons/year)		65,000	
3. Laterals (tons/year)		135,000	
4. Point Sources (tons/year)			
5. Other (tons/year)			
Implementation Plan			
1. Construction Start (year)	1990	1986	1989
2. Construction Period (years)	8	15	3
3. Expected Participants:			
a. Individuals (number)		1,200	
b. Groups (number)			
4. On-farm Practices:			
a. Treated Area (acres)		169,000	
b. Land Leveling (acres)		79,000	
c. Sprinkler Systems (acres)			
d. Farm Ditches/Pipelines (miles)		1,321	
5. Canal Lining (miles)			
6. Lateral Lining (miles)		104	
7. Pipe Laterals (miles)			
8. Winter Water Systems (miles)			
9. Collection Features (type)			
10. Delivery Systems (type)			
11. Disposal Facilities (type)			
12. Habitat Replacement (acres)		4,100	
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)		0	
b. Canals (tons/year)			
c. Laterals (tons/year)		0	
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)		300,000	
b. Canals (tons/year)			
c. Laterals (tons/year)		35,000	23,420
d. Point Sources (tons/year)			
e. Other (tons/year)			

Data Source: SCS/CO PF-65

	BR Lower Gunnison North Fork COLORADO	USDA Lower Gunnison COLORADO	BR Dolores COLORADO
Economic and Financial Analyses			
Department of the Interior:			
1. Plan Formulation Costs			
2. Nonsalinity Planning Costs			
3. Advance Planning Costs:			
a. Prior to Authorization			
b. After Authorization			
4. Nonsalinity Design Costs			
5. Salinity Const. Costs To Date			
6. Balance Salinity Const. Costs			24,358,639
7. Nonsalinity Construction Costs			
8. Habitat Replacement Costs			
9. Salinity IDC:			
a. Economic			
b. Financial			
10. Nonsalinity IDC			
a. Economic			
b. Financial			
11. Salinity OM&R Costs w/o Power			
12. Nonsalinity OM&R w/o Power			
13. Economic Cost of Power			
14. Financial Cost of Power			
15. Salinity M & E Costs			
16. Nonsalinity M & E Costs			
Department of Agriculture:			
1. Technical Assistance Costs		11,270,000	
2. M & E Costs		4,100,000	
3. Information and Education Costs		2,700,000	
4. Federal Cost-share Obligations		89,010,000	
5. Federal Const. Cost-share To Date			
6. Balance Federal Const. Cost-share		89,010,000	
7. Local Construction Cost-share		38,148,000	
8. Percent Federal Cost-share:		70	
9. Federal Habitat Costs		1,358,000	
10. Local Habitat Costs		582,000	
11. Other Local Costs			
12. Local O&M Costs		800,000	
13. Annual Value of Replacement Costs		1,474,300	
14. Federal IDC			
Cost Effectiveness:			
1. Total Salinity Construction Costs		102,980,000	24,358,639
2. Advance Planning Costs			
3. Habitat Replacement Costs		1,358,000	
4. IDC (Economic)		0	
5. Subtotal Investment		104,338,000	24,358,639
6. Annual Equivalent Investment Costs		8,900,031	2,077,792
7. Annual Salinity OM&R Costs		1,474,300	
8. Annual Economic Cost of Power			
9. Annual M & E Costs		349,730	
10. Annual Habitat OM&R Costs			
11. Annual Salinity Costs		10,724,061	2,077,792
12. Tons of Salt Removed Annually		335,000	23,420
13. Cost Effectiveness		32	89

	USDA McElmo	BR Glen Dot	USDA Mancos
	COLORADO	COLORADO	COLORADO
Date of Estimate:	7/81	1/83	1/83
Interest Rate:	7.63%	8.63%	7.88%
Estimate Adjustment for 10/84:			
10\84 Interest Rate	8.38%	8.38%	8.38%
IDC Adjustment for 10/84:			
Project Area			
1. Irrigated Area (total acres)	29,100		9,200
2. Potential Participants:			
a. Individuals (number)	342		95
b. Groups (number)			34
3. Canals (total miles)			104
4. Laterals (total miles)	235		
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)	51,000		13,000
2. Canals (tons/year)			10,000
3. Laterals (tons/year)	9,000		
4. Point Sources (tons/year)		429,000	
5. Other (tons/year)			
Implementation Plan			
1. Construction Start (year)	1992	1/	1995
2. Construction Period (years)	7	3	4
3. Expected Participants:			
a. Individuals (number)	238		57
b. Groups (number)			15
4. On-farm Practices:			
a. Treated Area (acres)	19,700		5,500
b. Land Leveling (acres)			
c. Sprinkler Systems (acres)	19,700		3,200
d. Farm Ditches/Pipelines (miles)	33		
5. Canal Lining (miles)			17
6. Lateral Lining (miles)			
7. Pipe Laterals (miles)	235		
8. Winter Water Systems (miles)			
9. Collection Features (type)		sp boxes & wells	
10. Delivery Systems (type)		pipeline	
11. Disposal Facilities (type)		evap ponds	
12. Habitat Replacement (acres)			
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)	29,000		1,100
b. Canals (tons/year)			7,700
c. Laterals (tons/year)	9,000		
d. Point Sources (tons/year)		287,000	
e. Other (tons/year)			

1/ Deferred pending identification of beneficial use of water

Data Source:	SCS/CO	9/85 Draft FR	SCS/CO

		USDA McElmo	BR Glen Dot	USDA Mancos
		COLORADO	COLORADO	COLORADO
Economic and Financial Analyses				
	Department of the Interior:			
1.	Plan Formulation Costs			
2.	Nonsalinity Planning Costs			
3.	Advance Planning Costs:			
	a. Prior to Authorization			
	b. After Authorization			
4.	Nonsalinity Design Costs			
5.	Salinity Const. Costs To Date			
6.	Balance Salinity Const. Costs		309,180,000	
7.	Nonsalinity Construction Costs			
8.	Habitat Replacement Costs			
9.	Salinity IDC:			
	a. Economic		17,499,000	
	b. Financial			
10.	Nonsalinity IDC			
	a. Economic			
	b. Financial			
11.	Salinity OM&R Costs w/o Power		2,622,000	
12.	Nonsalinity OM&R w/o Power			
13.	Economic Cost of Power			
14.	Financial Cost of Power		812,000	
15.	Salinity M & E Costs			
16.	Nonsalinity M & E Costs			
	Department of Agriculture:			
1.	Technical Assistance Costs	5,452,200		1,160,000
2.	M & E Costs	1,053,000		50,000
3.	Information and Education Costs	1,017,900		150,000
4.	Federal Cost-share Obligations	17,736,400		3,481,200
5.	Federal Const. Cost-share To Date			
6.	Balance Federal Const. Cost-share	17,736,400		3,481,200
7.	Local Construction Cost-share	9,550,400		2,320,800
8.	Percent Federal Cost-share:	65		60
9.	Federal Habitat Costs			
10.	Local Habitat Costs			
11.	Other Local Costs			
12.	Local O&M Costs	113,500		20,000
13.	Annual Value of Replacement Costs	398,900		76,000
14.	Federal IDC			
	Cost Effectiveness:			
1.	Total Salinity Construction Costs	24,206,500	309,180,000	4,791,200
2.	Advance Planning Costs			
3.	Habitat Replacement Costs	0		0
4.	IDC (Economic)	0	17,499,000	0
5.	Subtotal Investment	24,206,500	326,679,000	4,791,200
6.	Annual Equivalent Investment Costs	2,064,814	27,865,719	408,689
7.	Annual Salinity OM&R Costs	398,900	2,622,000	76,000
8.	Annual Economic Cost of Power		812,000	
9.	Annual M & E Costs	89,821		4,265
10.	Annual Habitat OM&R Costs			
11.	Annual Salinity Costs	2,553,535	31,299,719	488,954
12.	Tons of Salt Removed Annually	38,000	287,000	8,800
13.	Cost Effectiveness	67	109	56

	BR Lower Virgin 1/	USDA Virgin Valley	USDA Moapa
	NEVADA	NEVADA	NEVADA
Date of Estimate:	1/85	7/80	7/80
Interest Rate:	8.38%	7.38%	7.38%
Estimate Adjustment for 10/84:	99.32%		
10\84 Interest Rate	8.38%	8.38%	8.38%
IDC Adjustment for 10/84:	0.00%		
Project Area			
1. Irrigated Area (total acres)		4,625	4,982
2. Potential Participants:			
a. Individuals (number)		45	70
b. Groups (number)		4	1
3. Canals (total miles)		15.70	78.00
4. Laterals (total miles)			
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)		47,200	20,300
2. Canals (tons/year)		8,200	1,850
3. Laterals (tons/year)			
4. Point Sources (tons/year)	359,000		
5. Other (tons/year)			2,000
Implementation Plan			
1. Construction Start (year)	1993	1986	1986
2. Construction Period (years)	3	5	5
3. Expected Participants:			
a. Individuals (number)		45	70
b. Groups (number)		4	1
4. On-farm Practices:			
a. Treated Area (acres)		3,525	4,982
b. Land Leveling (acres)			
c. Sprinkler Systems (acres)			
d. Farm Ditches/Pipelines (miles)		27	14.30
5. Canal Lining (miles)		6.40	0.27
6. Lateral Lining (miles)			
7. Pipe Laterals (miles)			17.80
8. Winter Water Systems (miles)			
9. Collection Features (type)			
10. Delivery Systems (type)	32 mi. pipeline	open lined	pipeline
11. Disposal Facilities (type)			
12. Habitat Replacement (acres)		2,040	2,814
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)		30,407	12,395
b. Canals (tons/year)		6,800	1,835
c. Laterals (tons/year)			
d. Point Sources (tons/year)	270,000		
e. Other (tons/year)			270

1/ Total costs - does not reflect SCRB cost allocation

Data Source:	April 85 PFR	SCS/NV	SCS/NV

	BR Lower Virgin	USDA Virgin Valley	USDA Moapa
	NEVADA	NEVADA	NEVADA
Economic and Financial Analyses			
Department of the Interior:			
1. Plan Formulation Costs			
2. Nonsalinity Planning Costs			
3. Advance Planning Costs:			
a. Prior to Authorization			
b. After Authorization			
4. Nonsalinity Design Costs			
5. Salinity Const. Costs To Date			
6. Balance Salinity Const. Costs	128,122,449		
7. Nonsalinity Construction Costs			
8. Habitat Replacement Costs			
9. Salinity IDC:			
a. Economic	13,904,762		
b. Financial	18,672,109		
10. Nonsalinity IDC			
a. Economic			
b. Financial			
11. Salinity OM&R Costs w/o Power	6,555,102		
12. Nonsalinity OM&R w/o Power	6,555,102		
13. Economic Cost of Power			
14. Financial Cost of Power			
15. Salinity M & E Costs			
16. Nonsalinity M & E Costs			
Department of Agriculture:			
1. Technical Assistance Costs		610,000	824,000
2. M & E Costs		323,000	388,000
3. Information and Education Costs		200,000	275,000
4. Federal Cost-share Obligations		4,400,000	5,000,000
5. Federal Const. Cost-share To Date			
6. Balance Federal Const. Cost-share		4,400,000	5,000,000
7. Local Construction Cost-share		2,369,000	2,143,000
8. Percent Federal Cost-share:		65	70
9. Federal Habitat Costs		16,400	125,100
10. Local Habitat Costs		8,900	53,600
11. Other Local Costs			
12. Local O&M Costs		61,400	355,000
13. Annual Value of Replacement Costs		131,100	118,700
14. Federal IDC			
Cost Effectiveness:			
1. Total Salinity Construction Costs	128,122,449	5,210,000	6,099,000
2. Advance Planning Costs			
3. Habitat Replacement Costs		16,400	125,100
4. IDC (Economic)	13,904,762	0	0
5. Subtotal Investment	142,027,211	5,226,400	6,224,100
6. Annual Equivalent Investment Costs	12,114,921	445,812	530,916
7. Annual Salinity OM&R Costs	6,555,102	131,100	118,700
8. Annual Economic Cost of Power			
9. Annual M & E Costs		27,552	33,096
10. Annual Habitat OM&R Costs			
11. Annual Salinity Costs	18,670,023	604,464	682,712
12. Tons of Salt Removed Annually	270,000	37,207	19,500
13. Cost Effectiveness	69	16	35

	BR Las Vegas Wash Stage I Pittman NEVADA	BR Las Vegas Wash Stage I Whitney NEVADA	BR Las Vegas Wash Stage II NEVADA
Date of Estimate:	Complete		
Interest Rate:			
Estimate Adjustment for 10/84:			
10\84 Interest Rate			
IDC Adjustment for 10/84:			
Project Area			
1. Irrigated Area (total acres)			
2. Potential Participants:			
a. Individuals (number)			
b. Groups (number)			
3. Canals (total miles)			
4. Laterals (total miles)			
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)			
2. Canals (tons/year)			
3. Laterals (tons/year)			
4. Point Sources (tons/year)			
5. Other (tons/year)			
Implementation Plan			
1. Construction Start (year)	1984	1986	1992
2. Construction Period (years)	1	1	10
3. Expected Participants:			
a. Individuals (number)			
b. Groups (number)			
4. On-farm Practices:			
a. Treated Area (acres)			
b. Land Leveling (acres)			
c. Sprinkler Systems (acres)			
d. Farm Ditches/Pipelines (miles)			
5. Canal Lining (miles)			
6. Lateral Lining (miles)			
7. Pipe Laterals (miles)			
8. Winter Water Systems (miles)			
9. Collection Features (type)			
10. Delivery Systems (type)			
11. Disposal Facilities (type)			
12. Habitat Replacement (acres)			
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)	7,000		
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)		10,000	66,000
e. Other (tons/year)			
Data Source:	CRWQO	CRWQO	CRWQO

	BR Las Vegas Wash Stage I Pittman NEVADA	BR Las Vegas Wash Stage I Whitney NEVADA	BR Las Vegas Wash Stage II NEVADA
Economic and Financial Analyses			
Department of the Interior:			
1. Plan Formulation Costs			
2. Nonsalinity Planning Costs			
3. Advance Planning Costs:			
a. Prior to Authorization			
b. After Authorization			
4. Nonsalinity Design Costs			
5. Salinity Const. Costs To Date	1,381,800		
6. Balance Salinity Const. Costs		1,000,000	9,609,565
7. Nonsalinity Construction Costs			
8. Habitat Replacement Costs			
9. Salinity IDC:			
a. Economic			
b. Financial			
10. Nonsalinity IDC			
a. Economic			
b. Financial			
11. Salinity OM&R Costs w/o Power	50,000	75,000	300,000
12. Nonsalinity OM&R w/o Power			
13. Economic Cost of Power			
14. Financial Cost of Power			
15. Salinity M & E Costs			
16. Nonsalinity M & E Costs			
Department of Agriculture:			
1. Technical Assistance Costs			
2. M & E Costs			
3. Information and Education Costs			
4. Federal Cost-share Obligations			
5. Federal Const. Cost-share To Date			
6. Balance Federal Const. Cost-share			
7. Local Construction Cost-share			
8. Percent Federal Cost-share:			
9. Federal Habitat Costs			
10. Local Habitat Costs			
11. Other Local Costs			
12. Local O&M Costs			
13. Annual Value of Replacement Costs			
14. Federal IDC			
Cost Effectiveness:			
1. Total Salinity Construction Costs	1,381,800	1,000,000	9,609,565
2. Advance Planning Costs			
3. Habitat Replacement Costs			
4. IDC (Economic)			
5. Subtotal Investment	1,381,800	1,000,000	9,609,565
6. Annual Equivalent Investment Costs	117,868	85,300	819,696
7. Annual Salinity OM&R Costs	50,000	75,000	300,000
8. Annual Economic Cost of Power			
9. Annual M & E Costs			
10. Annual Habitat OM&R Costs			
11. Annual Salinity Costs	167,868	160,300	1,119,696
12. Tons of Salt Removed Annually	7,000	10,000	66,000
13. Cost Effectiveness	24	16	17

	BR San Juan	BR Uinta Stage One	BR Uinta Stage Two
	NEW MEXICO	UTAH	UTAH
Date of Estimate:		1/85	
Interest Rate:		8.38%	
Estimate Adjustment for 10/84:		99.32%	
10\84 Interest Rate		8.38%	
IDC Adjustment for 10/84:		0.00%	
Project Area			
1. Irrigated Area (total acres)		97,447	
2. Potential Participants:			
a. Individuals (number)			
b. Groups (number)			
3. Canals (total miles)			
4. Laterals (total miles)			
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)			
2. Canals (tons/year)			
3. Laterals (tons/year)			
4. Point Sources (tons/year)			
5. Other (tons/year)		450,000	
Implementation Plan			
1. Construction Start (year)		1990	
2. Construction Period (years)		8	
3. Expected Participants:			
a. Individuals (number)			
b. Groups (number)			
4. On-farm Practices:			
a. Treated Area (acres)			
b. Land Leveling (acres)			
c. Sprinkler Systems (acres)			
d. Farm Ditches/Pipelines (miles)			
5. Canal Lining (miles)		43.90	
6. Lateral Lining (miles)		11.60	
7. Pipe Laterals (miles)			
8. Winter Water Systems (miles)			
9. Collection Features (type)			
10. Delivery Systems (type)			
11. Disposal Facilities (type)			
12. Habitat Replacement (acres)			
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)		25,500	
d. Point Sources (tons/year)			
e. Other (tons/year)			

Data Source: 6/85 PFWD

DT:CRWQIP DATA TABLE - AUGUST 7, 1985 Page 14 of 20 Page 16 of 20

	BR San Juan	BR Uinta Stage One	BR Uinta Stage Two
	NEW MEXICO	UTAH	UTAH
Economic and Financial Analyses			
Department of the Interior:			
1. Plan Formulation Costs		2,500,000	
2. Nonsalinity Planning Costs			
3. Advance Planning Costs:			
a. Prior to Authorization		1,200,000	
b. After Authorization			
4. Nonsalinity Design Costs			
5. Salinity Const. Costs To Date			
6. Balance Salinity Const. Costs		21,405,388	
7. Nonsalinity Construction Costs			
8. Habitat Replacement Costs		993,197	
9. Salinity IDC:			
a. Economic		0	
b. Financial			
10. Nonsalinity IDC			
a. Economic			
b. Financial			
11. Salinity OM&R Costs w/o Power		160,004	
12. Nonsalinity OM&R w/o Power		73,000	
13. Economic Cost of Power			
14. Financial Cost of Power			
15. Salinity M & E Costs			
16. Nonsalinity M & E Costs			
Department of Agriculture:			
1. Technical Assistance Costs			
2. M & E Costs			
3. Information and Education Costs			
4. Federal Cost-share Obligations			
5. Federal Const. Cost-share To Date			
6. Balance Federal Const. Cost-share			
7. Local Construction Cost-share			
8. Percent Federal Cost-share:			
9. Federal Habitat Costs			
10. Local Habitat Costs			
11. Other Local Costs			
12. Local O&M Costs			
13. Annual Value of Replacement Costs			
14. Federal IDC			
Cost Effectiveness:			
1. Total Salinity Construction Costs		21,405,388	
2. Advance Planning Costs		1,200,000	
3. Habitat Replacement Costs		993,197	
4. IDC (Economic)		0	
5. Subtotal Investment		23,598,585	
6. Annual Equivalent Investment Costs		2,012,959	
7. Annual Salinity OM&R Costs		160,004	
8. Annual Economic Cost of Power			
9. Annual M & E Costs			
10. Annual Habitat OM&R Costs			
11. Annual Salinity Costs		2,172,963	
12. Tons of Salt Removed Annually		25,500	
13. Cost Effectiveness		85	

	USDA Uinta 1/	BR Price-San Rafael	USDA Price-San Rafael
	UTAH	UTAH	UTAH
Date of Estimate:	7/77	1/83	
Interest Rate:	6.63%	8.38%	
Estimate Adjustment for 10/84:		101.39%	
10\84 Interest Rate	8.38%	8.38%	
IDC Adjustment for 10/84:		0.00%	
Project Area			
1. Irrigated Area (total acres)	205,000	46,700	
2. Potential Participants:			
a. Individuals (number)	1,300		
b. Groups (number)	250		
3. Canals (total miles)	576	396.00	
4. Laterals (total miles)	859		
5. Point Sources (number)			
6. Other		215 ponds	
Salt Load Contribution			
1. On-farm (tons/year)	175,000		
2. Canals (tons/year)	25,000	258,000	
3. Laterals (tons/year)	20,000		
4. Point Sources (tons/year)	45,000	8,600	
5. Other (tons/year)	235,000	163,400	
Implementation Plan			
1. Construction Start (year)	1980	1989	
2. Construction Period (years)	15	3	
3. Expected Participants:			
a. Individuals (number)	800		
b. Groups (number)	150	8	
4. On-farm Practices:			
a. Treated Area (acres)	128,100		
b. Land Leveling (acres)	42,800		
c. Sprinkler Systems (acres)	79,400		
d. Farm Ditches/Pipelines (miles)	1,540		
5. Canal Lining (miles)			
6. Lateral Lining (miles)			
7. Pipe Laterals (miles)	306		
8. Winter Water Systems (miles)			
9. Collection Features (type)			
10. Delivery Systems (type)	Pipeline		
11. Disposal Facilities (type)			
12. Habitat Replacement (acres)	4,500		
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)	12,900		
b. Canals (tons/year)			
c. Laterals (tons/year)	2,700		
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)	69,400		
b. Canals (tons/year)			
c. Laterals (tons/year)	13,200		
d. Point Sources (tons/year)			
e. Other (tons/year)		22,000	

1/ Revised to reflect current studies

Data Source: SCS/UT 1/84PFWD/UPO

		USDA Uinta	BR Price-San Rfael	USDA Price-San Rfael
		UTAH	UTAH	UTAH
Economic and Financial Analyses				
	Department of the Interior:			
1.	Plan Formulation Costs		4,210,000	
2.	Nonsalinity Planning Costs			
3.	Advance Planning Costs:			
	a. Prior to Authorization			
	b. After Authorization			
4.	Nonsalinity Design Costs			
5.	Salinity Const. Costs To Date			
6.	Balance Salinity Const. Costs		7,985,389	
7.	Nonsalinity Construction Costs			
8.	Habitat Replacement Costs			
9.	Salinity IDC:			
	a. Economic		0	
	b. Financial			
10.	Nonsalinity IDC			
	a. Economic			
	b. Financial			
11.	Salinity OM&R Costs w/o Power		78,069	
12.	Nonsalinity OM&R w/o Power			
13.	Economic Cost of Power			
14.	Financial Cost of Power			
15.	Salinity M & E Costs			
16.	Nonsalinity M & E Costs			
	Department of Agriculture:			
1.	Technical Assistance Costs	11,307,000		
2.	M & E Costs	3,288,000		
3.	Information and Education Costs	210,000		
4.	Federal Cost-share Obligations	41,548,367		
5.	Federal Const. Cost-share To Date	6,688,867		
6.	Balance Federal Const. Cost-share	34,859,500		
7.	Local Construction Cost-share	40,859,500		
8.	Percent Federal Cost-share:	50		
9.	Federal Habitat Costs	385,000		
10.	Local Habitat Costs	1,155,000		
11.	Other Local Costs	4,000,000		
12.	Local O&M Costs	1,923,800		
13.	Annual Value of Replacement Costs	980,000		
14.	Federal IDC	0		
	Cost Effectiveness:			
1.	Total Salinity Construction Costs	53,065,367	7,985,389	
2.	Advance Planning Costs			
3.	Habitat Replacement Costs	385,000		
4.	IDC (Economic)	0		
5.	Subtotal Investment	53,450,367	7,985,389	
6.	Annual Equivalent Investment Costs	4,559,316	946,864	
7.	Annual Salinity OM&R Costs	980,000	78,069	
8.	Annual Economic Cost of Power			
9.	Annual M & E Costs	280,466		
10.	Annual Habitat OM&R Costs			
11.	Annual Salinity Costs	5,819,783	1,024,934	
12.	Tons of Salt Removed Annually	98,200	22,000	
13.	Cost Effectiveness	59	47	

	BR Dirty Devil	BR Big Sandy	USDA Big Sandy 1/
	UTAH	WYOMING	WYOMING
Date of Estimate:	1/84		10/84
Interest Rate:	8.63%		7.00%
Estimate Adjustment for 10/84:	101.39%		
10\84 Interest Rate	8.38%		8.38%
IDC Adjustment for 10/84:	-2.90%		
Project Area			
1. Irrigated Area (total acres)	27,900		15,700
2. Potential Participants:			
a. Individuals (number)			84
b. Groups (number)			9
3. Canals (total miles)			
4. Laterals (total miles)			
5. Point Sources (number)			
6. Other			
Salt Load Contribution			
1. On-farm (tons/year)			90,100
2. Canals (tons/year)			
3. Laterals (tons/year)			
4. Point Sources (tons/year)		164,000	
5. Other (tons/year)	155,000		24,300
Implementation Plan			
1. Construction Start (year)	1989		1986
2. Construction Period (years)	4		10
3. Expected Participants:			
a. Individuals (number)			84
b. Groups (number)			9
4. On-farm Practices:			
a. Treated Area (acres)			15,700
b. Land Leveling (acres)			2,500
c. Sprinkler Systems (acres)			11,000
d. Farm Ditches/Pipelines (miles)			146
5. Canal Lining (miles)			
6. Lateral Lining (miles)			
7. Pipe Laterals (miles)			
8. Winter Water Systems (miles)			
9. Collection Features (type)	shallow wells		
10. Delivery Systems (type)	15000 ft pipeln		
11. Disposal Facilities (type)	injection wells		
12. Habitat Replacement (acres)			1,290
Salt Load Reduction			
1. To date:			
a. On-farm (tons/year)			
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)			
e. Other (tons/year)			
2. Potential/Balance:			
a. On-farm (tons/year)			52,900
b. Canals (tons/year)			
c. Laterals (tons/year)			
d. Point Sources (tons/year)			
e. Other (tons/year)	20,600		

1/ Subject to low pressure sprinkler plan revisions

Data Source: 2/85 PFWO SCS/WY

		BR Dirty Devil	BR Big Sandy	USDA Big Sandy
		UTAH	WYOMING	WYOMING
Economic and Financial Analyses				
	Department of the Interior:			
1.	Plan Formulation Costs	2,700,000		
2.	Nonsalinity Planning Costs			
3.	Advance Planning Costs:			
	a. Prior to Authorization	912,500		
	b. After Authorization			
4.	Nonsalinity Design Costs			
5.	Salinity Const. Costs To Date			
6.	Balance Salinity Const. Costs	10,232,167		
7.	Nonsalinity Construction Costs			
8.	Habitat Replacement Costs			
9.	Salinity IDC:			
	a. Economic	1,019,960		
	b. Financial			
10.	Nonsalinity IDC			
	a. Economic			
	b. Financial			
11.	Salinity OM&R Costs w/o Power	293,014		
12.	Nonsalinity OM&R w/o Power			
13.	Economic Cost of Power	665,111		
14.	Financial Cost of Power			
15.	Salinity M & E Costs			
16.	Nonsalinity M & E Costs			
	Department of Agriculture:			
1.	Technical Assistance Costs			2,280,000
2.	M & E Costs			540,000
3.	Information and Education Costs			585,000
4.	Federal Cost-share Obligations			7,438,000
5.	Federal Const. Cost-share To Date			
6.	Balance Federal Const. Cost-share			7,438,000
7.	Local Construction Cost-share			3,187,000
8.	Percent Federal Cost-share:			70
9.	Federal Habitat Costs			797,400
10.	Local Habitat Costs			341,700
11.	Other Local Costs			2,654,900
12.	Local O&M Costs			315,900
13.	Annual Value of Replacement Costs			339,000
14.	Federal IDC			0
	Cost Effectiveness:			
1.	Total Salinity Construction Costs	10,232,167		10,303,000
2.	Advance Planning Costs	912,500		
3.	Habitat Replacement Costs			797,400
4.	IDC (Economic)	1,019,960		0
5.	Subtotal Investment	12,164,627		11,100,400
6.	Annual Equivalent Investment Costs	1,037,643		946,864
7.	Annual Salinity OM&R Costs	293,014		339,000
8.	Annual Economic Cost of Power	665,111		
9.	Annual M & E Costs			46,062
10.	Annual Habitat OM&R Costs			
11.	Annual Salinity Costs	1,995,768		1,331,926
12.	Tons of Salt Removed Annually	20,600		52,900
13.	Cost Effectiveness	97		25

APPENDIX B

SALT LOAD REDUCTION TARGET ESTIMATION

SALT LOAD REDUCTION TARGET ESTIMATION

Salt load reduction required to maintain the Lower Basin standards was estimated using a 3-step procedure.

1. A 15-trace CRSS simulation was made using the Reclamation demand data base (given in Progress Report 12) and initialized at 1984 conditions. Existing and ongoing salinity control project salt load reductions were included as shown in Table B-1. The simulation period was 1985-2020.

2. CRSS output was used to compute the salt load reduction required to reduce the TDS at Imperial Dam to the standard (879 mg/L). This was done using the future-effects equation for projects above Parker Dam:

$$\Delta TDS = \left[Q_{BP} \frac{L_{AP} - \Delta L}{Q_{AP}} - L_{BP} \right] \frac{k}{Q_I}$$

where: ΔTDS = change in TDS (mg/L) at Imperial Dam
Q_{BP} = discharge (kac. ft) below Parker Dam
L_{AP} = salt load (kton) above Parker Dam
ΔL = change in salt load above Parker Dam
Q_{AP} = discharge above Parker Dam
L_{BP} = salt load below Parker Dam
k = conversion from ton/ac.ft to mg/L = 735.46
Q_I = discharge at Imperial Dam

The difference between the predicted TDS at Imperial Dam (TDS_I) and the standard was substituted for ΔTDS and the equation was solved for ΔL:

$$\Delta L = L_{AP} - \frac{Q_{AP}}{Q_{BP}} \left[\frac{Q_I (TDS_I - 879)}{735.46} + L_{BP} \right]$$

The required salt load reduction, ΔL, was then evaluated for each year of the simulation period using CRSS output values for L_{AP}, Q_{AP}, Q_{BP}, L_{BP}, Q_I, and TDS_I. These values and resultant values are displayed in Table B-2.

3. Computed reductions (ΔL) exhibited significant scatter (Figure 9, main report) due to oscillations in the CRSS output. Therefore, a smooth curve was fit

through the data. The best fit was achieved using a logistic growth curve of the form:

$$y = \frac{a}{1 + \exp(b-cx)}$$

The coeffiecients were evaluated using non-linear, least - squares regression with the SPSS (Statistical Package for the Social Sciences) Marquardt method (Robinson, B; 1979; SPSS Program NONLINEAR - Nonlinear Regression; Manual 433, Vogleback Computing Center, Northwestern University). The computed reductions were regressed against sequential year numbers, with year one corresponding to 1995, the first year in which the standard was exceeded. The resultant best fit target values are given in Table B-2 and plotted on Figure 9 in the main report.

Table B-1. - Salt Load Reduction from Existing Salinity Control Projects

Project	Reduction (kTon/yr)
Reclamation	
Grand Valley, Stage I	17.7 1/
Meeker Dome	48.0 2/
Las Vegas Wash, Pittman Bypass	7.0
USDA	
Grand Valley	27.3 3/
Uinta Basin	15.6

1/ A more recent estimate is 19.9 kTon/yr
2/ The July 1985 estimate is 50.0 kTon/yr
3/ The 1985 estimate is 23.1 kTon/yr

Table B-2. CRSS results and salt load reduction targets

YEAR	TDS AT IMPERIAL (mg/L)	-----DISCHARGE (KACFT)----- ABOVE PARKER	BELOW PARKER	AT IMPERIAL	-----SALT LOAD (KTON)---------- ABOVE PARKER	BELOW PARKER	COMPUTED REDUCTION	BEST FIT TARGET
1986	624.0	11853.5	10207.0	9333.0	8767.7	7549.8	.0	.0
1987	636.0	11178.7	9247.0	8378.0	8405.4	6952.9	.0	.0
1988	683.0	10251.8	8062.0	7224.0	8112.7	6379.8	.0	.0
1989	726.0	9557.2	7360.0	6512.0	7939.9	6114.5	.0	.0
1990	775.0	9692.4	7576.0	6668.0	8671.6	6778.1	.0	.0
1991	801.0	10659.2	8440.0	7560.0	10000.4	7918.3	.0	.0
1992	827.0	9722.6	7457.0	6580.0	9280.2	7117.7	.0	.0
1993	833.0	9810.4	7589.0	6741.0	9457.4	7316.0	.0	.0
1994	850.0	9774.6	7526.0	6666.0	9582.4	7378.0	.0	.0
1995	887.0	9416.8	7271.0	6387.0	9654.2	7454.3	90.0	83.0
1996	900.0	10372.3	8041.0	7185.0	10887.7	8440.5	264.6	122.0
1997	901.0	9365.7	7227.0	6375.0	9741.9	7517.3	247.1	177.0
1998	894.0	9314.9	7229.0	6405.0	9625.7	7470.2	168.3	251.0
1999	891.0	9996.6	7725.0	6888.0	10330.2	7982.8	145.4	346.0
2000	927.0	9154.0	7084.0	6192.0	9783.0	7570.8	522.2	461.0
2001	943.0	9781.5	7576.0	6708.0	10719.7	8302.6	753.7	590.0
2002	950.0	9061.8	6992.0	6121.0	9893.9	7634.1	765.8	724.0
2003	941.0	9348.1	7277.0	6429.0	10181.2	7925.5	696.2	851.0
2004	949.0	9700.0	7506.0	6642.0	10630.3	8225.9	817.0	962.0
2005	981.0	8801.4	6776.0	5883.0	9956.7	7665.5	1059.8	1053.0
2006	1000.0	9415.2	7281.0	6412.0	10932.8	8454.5	1364.1	1123.0
2007	1003.0	8911.7	6889.0	6018.0	10275.4	7943.2	1312.6	1174.0
2008	972.0	9708.1	7637.0	6789.0	10982.5	8639.5	1091.3	1211.0
2009	967.0	9968.9	7683.0	6819.0	11182.6	8618.4	1058.7	1236.0
2010	995.0	8806.0	6854.0	5960.0	10129.6	7884.2	1207.8	1253.0
2011	1012.0	9193.5	7161.0	6291.0	10800.3	8412.6	1460.6	1265.0
2012	1011.0	8673.3	6817.0	5944.0	10106.7	7943.6	1357.3	1272.0
2013	986.0	9199.6	7165.0	6316.0	10532.3	8202.9	1179.8	1278.0
2014	981.0	9749.4	7477.0	6612.0	11095.4	8509.3	1195.7	1281.0
2015	1008.0	9033.5	6900.0	6007.0	10550.9	8059.0	1379.4	1283.0
2016	1019.0	9541.1	7526.0	6656.0	11338.3	8943.7	1606.3	1286.0
2017	1013.0	8741.9	6892.0	6020.0	10210.3	8049.7	1391.2	1286.0
2018	985.0	9125.7	7182.0	6334.0	10435.2	8212.6	1160.0	1286.0
2019	969.0	9507.6	7478.0	6619.0	10703.9	8418.9	1029.8	1287.0
2020	991.0	8822.1	6998.1	6125.0	10184.0	8078.3	1175.9	1287.0

APPENDIX C

BUDGET CONSTRAINT MODEL
DATA AND SUPPLEMENTAL RESULTS

Table C-1. Maximum Budget and Salt Load Reduction Targets Used in the Budget Constraint Model 1/

YEAR	MAXIMUM COST TARGET 2/ (Millions of Dollars) ANNUAL	CUMULATIVE	SALT LOAD REDUCTION TARGET (kTon) 3/
1986	20	20	0
1987	20	40	0
1988	30	70	0
1989	40	110	0
1990	50	150	0
1991	50	190	83
1992	50	230	122
1993	50	270	177
1994	50	310	251
1995	50	350	346
1996	50	390	461
1997	50	430	590
1998	50	470	724
1999	50	510	851
2000	50	550	962
2001	50	590	1053
2002	50	630	1123
2003	50	670	1174
2004	50	710	1211
2005	50	750	1236
2006	50	790	1253
2007	50	830	1265
2008	50	870	1272
2009	50	870	1278
2010	50	870	1281

1/ All minimum budget targets were zero.
2/ The two columns are independent - $50 million is the annual maximum but cumulative totals do not allow a full $50 million to be added each year.
3/ Targets were computed for Imperial Dam and shifted forward 4 years to allow project impacts to completely pass through Lakes Powell and Mead.

Table C-2. Project Data Used in the Budget Constraints Model

PROJECT	SALINITY COST		CONSTRUC-TION PERIOD (Years)	FIXED START (Year)	SALT LOAD REDUCTION (kton)	DELAYED IMPACT 1/
	CONSTRUCTION (Total remaining) (millions of dollars)	OM&R (Annual)				
Reclamation						
Grand Valley, Stage II	121.4	0.45	10	1986	120.3	
Grand Valley, deferred	77.5	0.28	9		23.2	
Paradox Valley		0.32	4	1986 2/	180.0	yes
Dolores	24.4	0.00	3	1989	23.4	
Lower Gunnison, Winter Water	14.9	0.00	1	1987	74.3	
Lower Gunnison, Canal Lining	142.1	0.00	6		66.3	
Las Vegas Wash, Whitney Area	1.0	0.08	1	1986	10.0	
Las Vegas Wash, remaining area	9.6	0.30	10		66.0	
Uinta Basin	22.4	0.16	8		25.5	
Dirty Devil	11.2	0.96	4		20.6	yes
Price-San Rafael	8.0	0.08	3		22.0	
Lower Virgin	142.0	3.30	3		270.0	yes
BLM						
Sinbad Valley	8.1	0.06	3		7.5	yes
USDA						
Grand Valley	27.5	0.00	9	1986 2/	106.7	
Uinta Basin	33.2	0.00	10	1986 2/	82.6	
Lower Gunnison	90.4	0.00	15		335.0	
Moapa Valley	5.1	0.00	5		19.2	
Virgin Valley	4.4	0.00	5		37.2	
McElmo Creek	17.7	0.00	7	1992 3/	38.0	
Mancos Valley	3.5	0.00	4		8.8	
Big Sandy	8.2	0.00	10		52.9	

1/ Projects with delayed impacts must be completely built before any salt load reduction occurs.
2/ Ongoing projects - remaining cost, construction period and salt load reduction are given.
3/ McElmo will start the year following completion of Dolores.

APPENDIX D

REPAYMENT ANALYSIS

Repayment Analysis

Tables D-1 and D-2 show the repayment dollars needed and the repayment capability of the Basin States for the $570 million investment level without and with inflation costs added.

For purposes of basin fund repayment analysis, the USDA costs for technical assistance, education, and monitoring and evaluation are excluded. However, these Federal costs are costs of implementation and are considered in the computed cost-effectiveness values.

The basin fund revenues used in this analysis are the numbers provided by Nevada in 1984. These numbers will be updated for the 1986 analysis in the manner requested by the Forum in their comments on our initial draft. Total revenue from the Lower Colorado River Basin Fund will be calculated based on CRSS energy from Hoover and Parker-Davis (perhaps 10-year moving average) at 2.5 mills/kwh. Payments will be deducted for Hoover deficiencies, annual amortization of presently authorized projects, and annual cost of fixed starts. The result is revenue available annually for the balance of projects required to meet salt load reduction targets. Starting in 1986, the fixed start projects may be rescheduled if necessary so that adequate revenue balance is available for other projects.

PRELIMINARY CRWQIP INVESTMENT SCHEDULE - OCTOBER 1985/EVL85IV $570 Million Alternative --------- Without Inflation

$ in 1,000's P.L.93-320 Units	Total Investment Costs	Investment and O&M Costs	Total thru 1984	CRWQIP Date Table 1985	1986	1987	1988	October 1985 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Grand Valley Stage I	28,856	29,048	28,856			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Valley Stage II	126,492	126,807		3,950	2,429	4,858	8,502	10,931	9,716	10,931	9,716	9,716	10,931	9,716	10,931	9,716	9,716	3,644	55	55	55	55	55	55	55	55	55	55	55
Grand Valley - Balance -	77,451	77,757										3,898	7,745	10,069	10,843	10,069	10,069	10,069	10,069	5,422	34	34	34	34	34	34	34	34	34
Crystal Geyser	0	0																											
Las Vegas Wash - Pittman -	1,382	2,602	1,382	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Las Vegas Wash - Whitney -	1,000	2,000			1,000	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Las Vegas Wash Stage II	9,610	11,718										200	865	1,153	1,057	1,153	1,153	1,153	1,153	1,057	1,153	577	300	300	300	300	300	300	300
Paradox Valley Unit	62,882	69,622	13,390	2,350	12,267	12,728	12,257	9,900	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321	321
Subtotal P.L.93-320 Units:	306,583	319,626	43,628	6,350	15,736	17,719	20,891	20,963	10,170	11,305	10,170	13,260	19,418	21,104	23,301	21,296	21,392	15,319	11,731	6,988	1,696	1,120	843	843	843	843	843	843	843
Cumulative Subtotal:			43,628	49,978	65,714	83,433	104,325	126,288	136,458	146,843	157,013	170,281	189,699	210,803	234,104	255,400	276,872	292,191	303,922	310,910	312,606	313,725	314,568	315,411	316,254	317,097	317,940	318,783	319,626
LCRB Fund Share																													
Grand Valley						124	124	124	124	124	124	124	124	124	124	124	124	124	669	669	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005
Las Vegas Wash				16	16	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	141	141	141	141	141
Paradox Valley Unit									335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335	335
Subtotal - LCRB Fund Share				16	16	161	161	161	496	496	496	496	496	496	496	496	496	496	1,041	1,041	1,378	1,378	1,378	1,378	1,482	1,482	1,482	1,482	1,482
P.L.98-569 Units																													
Grand Valley SCS	35,500	35,500	6,000	2,000	3,300	3,025	3,300	3,300	3,025	3,300	3,300	3,300	1,650																
Uinta SCS	41,933	41,933	6,689	2,000	3,657	3,324	3,657	3,324	3,657	3,324	3,657	3,324	3,657	1,662															
Lower Gunnison - Winter Water -	14,901	14,901				14,901																							
Lower Gunnison Stage I	0	0																											
Lower Gunnison - North Fork -	0	0																											
Lower Gunnison SCS	90,368	90,368																											
Dolores - Salinity Control -	24,359	24,359								904	3,615	6,326	7,229	6,326	7,229	7,229	7,229	7,229	7,229	7,229	6,326	7,229	6,326	2,711					
McElmo Creek SCS	17,736	17,736						6,577	9,743	8,038																			
Big Sandy SCS	8,235	8,235									1,064	2,838	3,015	2,838	3,015	3,015	1,951												
Virgin Valley SCS	4,416	4,416										247	741	988	986	988	988	988	986	988	494								
Moapa Valley SCS	5,125	5,125													538	1,016	1,060	1,016	795										
Price-San Rafael SCS	0	0															615	1,179	1,238	1,179	923								
Mancos Valley SCS	3,481	3,481																											
Palo Verde Irrig District SCS	0	0															627	1,810	1,810	835									
Subtotal P.L.98-569 Units	246,055	246,055	12,689	4,000	6,957	21,250	6,957	13,201	16,425	15,566	11,636	16,035	16,293	11,814	11,680	12,249	12,470	11,422	11,170	10,232	7,742	7,229	6,326	2,711	0	0	0	0	0
Cumulative Subtotal:			12,689	16,689	23,646	44,896	51,853	65,054	81,480	97,046	108,682	124,717	141,010	152,824	164,504	176,753	189,223	200,645	211,815	222,047	229,789	237,019	243,344	246,055	246,055	246,055	246,055	246,055	246,055
Subtotal - LCRB Fund Share			0	0	1,774	5,419	1,774	3,366	4,188	3,969	2,967	4,089	4,155	3,013	2,979	3,123	3,188	2,913	2,848	2,609	1,974	1,844	1,613	691	0	0	0	0	0
Remaining Units																													
Sinbad Valley (BLM)	8,077	8,396																				2,101	3,231	2,665	64	64	64	64	64
Uinta Stage I	22,399	23,039											1,120	2,912	3,136	3,360	3,360	3,136	3,360	2,016	160	160	160	160	160	160	160	160	160
Uinta Stage II	0	0																											
Dirty Devil	11,252	24,666										2,025	3,263	3,263	2,701	958	958	958	958	958	958	958	958	958	958	958	958	958	958
Price-San Rafael	7,985	8,922													2,156	3,194	2,635	78	78	78	78	78	78	78	78	78	78	78	78
Lower Virgin	0	0																											
Palo Verde Irrigation District	0	0																											
Big Sandy	0	0																											
San Juan River	0	0																											
Subtotal Remaining Units	49,713	65,023	0	0	0	0	0	0	0	0	0	2,025	4,383	6,175	7,992	7,512	6,953	4,172	4,396	3,052	1,196	3,377	4,427	3,862	1,268	1,268	1,268	1,268	1,268
Cumulative Subtotal:			0	0	0	0	0	0	0	0	0	2,025	6,408	12,583	20,576	28,088	35,041	39,213	43,609	46,661	47,857	51,234	55,661	59,523	60,783	62,043	63,303	64,563	65,823
Subtotal - LCRB Fund Share												516	1,110	1,575	2,038	1,916	1,773	1,064	1,121	770	305	861	1,129	985	321	321	321	321	321
TOTAL - ALL UNITS	602,351	631,504	56,317	10,350	22,693	38,970	27,848	34,165	26,595	26,951	21,806	31,329	40,094	39,093	43,054	41,057	40,015	30,913	27,297	20,272	10,635	11,726	11,596	7,416	2,103	2,103	2,103	2,103	2,103
CUMULATIVE TOTAL:			56,317	66,667	89,360	128,330	156,178	190,343	216,938	243,889	265,695	297,024	337,118	376,210	419,264	460,321	501,136	532,049	559,346	579,617	590,252	601,978	613,574	620,989	623,092	625,195	627,298	629,401	631,504
TOTAL - LCRB Fund Share			0	16	1,791	5,580	1,935	3,527	4,685	4,466	3,464	5,102	5,769	5,084	5,513	5,535	5,449	4,473	5,010	4,429	3,657	4,082	4,119	3,054	1,803	1,803	1,803	1,803	1,803
LCRB Funds			0	0	0	3,050	7,669	7,403	7,358	7,358	7,358	6,327	6,327	6,327	6,327	6,327	6,327	6,327	6,327	6,264	6,264	6,142	6,082	6,377	8,596	8,534	8,472	8,410	8,348
Balance			0	(16)	(1,791)	(2,530)	5,734	3,876	2,673	2,892	3,894	1,225	558	1,243	814	792	878	1,854	1,317	1,835	2,547	2,060	1,963	3,323	6,793	6,731	6,669	6,607	6,545
Previous Balance			0	0	(19)	(2,033)	(5,127)	607	4,482	7,155	10,047	13,942	15,167	15,725	16,968	17,782	18,574	19,451	21,306	22,622	24,458	27,005	29,065	31,027	34,351	41,143	47,874	54,542	61,149
Balance			0	(16)	(1,809)	(4,563)	607	4,482	7,155	10,047	13,942	15,167	15,725	16,968	17,782	18,574	19,451	21,306	22,622	24,458	27,005	29,065	31,027	34,351	41,143	47,874	54,542	61,149	67,694
Interest Component			0	(2)	(224)	(565)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL - Balance			0	(19)	(2,033)	(5,127)	607	4,482	7,155	10,047	13,942	15,167	15,725	16,968	17,782	18,574	19,451	21,306	22,622	24,458	27,005	29,065	31,027	34,351	41,143	47,874	54,542	61,149	67,694

Table D-1

PRELIMINARY CRWQIP INVESTMENT SCHEDULE - OCTOBER 1985/EVL85IV $570 Million Alternative - 0.045633 Inflation Rate

$ in 1,000's P.L.93-320 Units	Total Investment Costs	Investment and O&M with Inflation	Total thru 1984	CRWQIP Data Table October 1985 1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Grand Valley Stage I	28,856	29,224	28,856			9	9	10	10	10	11	11	12	12	13	14	14	15	16	16	17	18	19	20	20	21	22	23	24
Grand Valley Stage II	125,402	179,802		3,950	2,540	5,312	9,719	13,067	12,145	14,286	13,279	13,884	16,333	15,181	17,857	16,598	17,365	6,805	107	112	117	123	128	134	140	147	153	160	168
Grand Valley - Balance -	77,451	134,957										4,427	11,573	15,731	17,715	17,200	17,985	18,005	19,664	11,071	73	76	79	83	87	91	95	99	104
Crystal Geyser	0	0																											
Las Vegas Wash - Pittman -	1,382	3,782	1,382	50	52	55	57	60	62	65	68	71	75	78	82	85	89	93	98	102	107	112	117	122	128	133	140	146	153
Las Vegas Wash - Whitney -	1,000	4,492			1,846	82	86	90	94	98	102	107	112	117	123	128	134	140	146	153	160	167	175	183	191	200	209	219	229
Las Vegas Wash Stage II	9,610	23,473											431	1,351	1,884	1,806	2,060	2,154	2,252	2,159	2,462	1,287	700	732	766	801	837	875	915
Paradox Valley Unit	62,882	81,969	13,390	2,350	12,816	13,916	14,013	11,834	481	419	439	459	480	501	524	548	573	599	627	655	685	717	749	783	819	857	896	937	979
Subtotal P.L.93-320 Units:	386,583	457,699	43,628	6,350	16,454	19,373	23,804	25,060	12,712	14,880	13,899	18,960	29,815	32,972	38,198	36,379	38,210	28,612	22,910	14,269	3,622	2,500	1,968	2,050	2,152	2,250	2,353	2,468	2,572
Cumulative Subtotal:			43,628	49,978	66,432	85,806	109,690	134,750	147,462	162,342	176,240	195,201	224,216	257,188	295,386	331,765	369,975	398,587	421,497	435,766	439,388	441,887	443,855	445,913	448,065	450,314	452,667	455,135	457,699
LCRB Fund Share																													
Grand Valley						124	124	124	124	124	124	124	124	124	124	124	124	124	600	600	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
Las Vegas Wash				16	16	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	235	235	235	235
Paradox Valley Unit									353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353	353
Subtotal - LCRB Fund Share				16	16	163	163	163	515	515	515	515	515	515	515	515	515	515	1,071	1,071	1,416	1,416	1,416	1,416	1,612	1,612	1,612	1,612	1,612
P.L.98-569 Units																													
Grand Valley SCS	35,500	42,261	6,000	2,000	3,451	3,307	3,773	3,945	3,701	4,313	4,510	4,716	2,465																
Uinta SCS	41,933	51,028	6,689	2,000	3,824	3,635	4,101	3,974	4,571	4,345	4,998	4,751	5,464	2,597															
Lower Gunnison - Winter Water -	14,901	16,292				16,292																							
Lower Gunnison Stage I	0	0																											
Lower Gunnison - North Fork -	0	0																											
Lower Gunnison SCS	98,368	166,339								1,101	4,940	9,040	10,882	9,883	11,811	12,350	12,913	13,503	14,119	14,763	13,507	16,141	14,768	6,610					
Dolores - Salinity Control -	24,359	38,547						7,862	12,179	10,506																			
McElmo Creek SCS	17,736	28,010									1,454	4,055	4,505	4,434	4,926	5,151	3,485												
Big Sandy SCS	8,235	14,626										353	1,107	1,544	1,400	1,600	1,765	1,846	1,769	2,018	1,855								
Virgin Valley SCS	4,416	7,944													866	1,735	1,893	1,897	1,553										
Moapa Valley SCS	5,125	10,079															1,099	2,202	2,402	2,407	1,970								
Price-San Rafael SCS	0	0																											
Mancos Valley SCS	3,401	6,603															1,119	1,886	1,972	1,706									
Palo Verde Irrig District SCS	0	0																											
Subtotal P.L.98-569 Units	246,855	373,889	12,689	4,000	7,274	23,234	7,953	15,781	20,531	20,345	15,902	22,914	24,345	18,458	19,002	20,924	22,274	21,333	21,014	20,894	16,532	16,141	14,768	6,610	0	0	0	0	0
Cumulative Subtotal:			12,689	16,689	23,963	47,197	55,151	70,932	91,463	111,808	127,710	150,625	174,969	193,428	212,510	233,434	255,709	277,041	298,055	319,750	336,282	352,423	367,191	373,809	373,809	373,809	373,809	373,809	373,889
Subtotal - LCRB Fund Share			0	0	1,855	5,925	2,028	4,024	5,236	5,108	4,055	5,843	6,208	4,707	4,866	5,336	5,600	5,440	5,563	5,328	4,216	4,116	3,766	1,688	0	0	0	0	0
Remaining Units																													
Sinbad Valley (BLM)	8,077	19,810																				4,869	7,543	6,507	163	170	178	186	195
Uinta Stage I	22,399	43,321															1,673	4,549	5,123	5,739	6,001	357	374	391	408	427	447	467	488
Uinta Stage II	0	0																											
Dirty Devil	11,252	48,483										2,894	4,076	5,898	4,412	1,637	1,711	1,798	1,871	1,957	2,046	2,139	2,237	2,339	2,446	2,557	2,674	2,796	2,924
Price-San Rafael	7,985	15,949													3,522	5,456	4,787	146	152	159	167	174	182	191	199	208	218	228	238
Lower Virgin	0	0																											
Palo Verde Irrigation District	0	0																											
Big Sandy	0	0																											
San Juan River	0	0																											
Subtotal Remaining Units	49,713	127,483	0	0	0	0	0	0	0	0	0	2,894	6,549	9,648	13,857	12,833	12,420	7,792	8,585	6,233	2,554	7,540	10,335	9,427	3,216	3,363	3,516	3,677	3,845
Cumulative Subtotal:			0	0	0	0	0	0	0	0	0	2,894	9,444	19,091	32,148	44,981	57,401	65,193	73,778	80,010	82,565	90,104	100,440	109,866	113,083	116,445	119,962	123,639	127,483
Subtotal - LCRB Fund Share												738	1,670	2,460	3,330	3,272	3,167	1,987	2,189	1,589	651	1,923	2,635	2,484	820	858	897	938	980
TOTAL - ALL UNITS	682,351	958,991	56,317	10,350	23,728	42,608	31,837	40,841	33,243	35,225	29,801	44,769	59,909	61,079	70,337	70,135	72,905	57,737	53,309	41,396	22,708	26,181	27,071	18,102	5,368	5,613	5,869	6,137	6,417
CUMULATIVE TOTAL:			56,317	66,667	90,395	133,003	164,840	205,681	238,925	274,150	303,951	348,720	408,629	469,707	540,044	610,180	683,084	740,821	794,130	835,526	858,234	884,415	911,486	929,588	934,956	940,569	946,438	952,574	958,991
TOTAL - LCRB Fund Share			0	16	1,871	6,087	2,191	4,187	5,751	5,743	4,570	7,896	8,393	7,682	8,711	9,123	9,362	7,942	8,823	7,988	6,283	7,454	7,817	5,507	2,432	2,478	2,589	2,558	2,592
LCRB Funds			0	0	0	3,050	7,669	7,403	7,358	7,358	7,358	6,327	6,327	6,327	6,327	6,327	6,327	6,327	6,327	6,264	6,204	6,142	6,082	6,377	8,596	8,534	8,472	8,410	8,348
Balance			0	(16)	(1,871)	(3,037)	5,478	3,216	1,607	1,615	2,788	(769)	(2,066)	(1,355)	(2,384)	(2,796)	(3,035)	(1,615)	(2,496)	(1,724)	(79)	(1,312)	(1,735)	870	6,164	6,064	5,963	5,868	5,756
Previous Balance			0	0	(19)	(2,124)	(5,800)	(362)	2,855	4,462	6,117	8,905	8,135	6,869	4,714	2,330	(524)	(3,999)	(6,389)	(9,894)	(13,057)	(14,760)	(18,062)	(22,246)	(24,022)	(20,060)	(15,736)	(10,982)	(5,756)
Balance			0	(16)	(1,890)	(5,161)	(322)	2,855	4,462	6,117	8,905	8,135	6,869	4,714	2,330	(466)	(3,559)	(5,614)	(8,885)	(11,619)	(13,135)	(16,073)	(19,797)	(21,376)	(17,858)	(14,003)	(9,773)	(5,122)	0
Interest Component			0	(2)	(234)	(639)	(40)	0	0	0	0	0	0	0	0	(58)	(440)	(695)	(1,090)	(1,438)	(1,625)	(1,989)	(2,450)	(2,645)	(2,210)	(1,733)	(1,209)	(634)	0
TOTAL - Balance			0	(19)	(2,124)	(5,800)	(362)	2,855	4,462	6,117	8,905	8,135	6,869	4,714	2,330	(524)	(3,999)	(6,389)	(9,894)	(13,057)	(14,760)	(18,062)	(22,246)	(24,022)	(20,068)	(15,736)	(10,982)	(5,756)	0

Table D-2

APPENDIX E

RISK ANALYSIS FOR EVALUATING AND RANKING SALINITY CONTROL PROJECTS

Appendix E

Risk Analysis for Evaluating and Ranking Salinity Control Projects

Two types of data are required for this analysis: project characteristics and probabilities. The first type of data is already available in this report. The technical staff has predicted the cost for each project and the expected level of performance.

The next step is to estimate the probabilities associated with each project's predicted characteristics. For example, it may be more or less certain that a given level of salt will be removed. Project costs or implementation may be more or less certain. These uncertainties can be measured through the specification or assignment, by knowledgeable experts, of both discrete probabilities and probability distribution.

Consider the uncertainty in a project's actual performance. As shown in figure E-1 below, Project A is predicted to remove 30,000 tons of salt per year. However, the project may actually remove more or less. To describe this undertainty, technical staff can describe the likelihood that each level of performance on the scale will be the actual result of implementation.

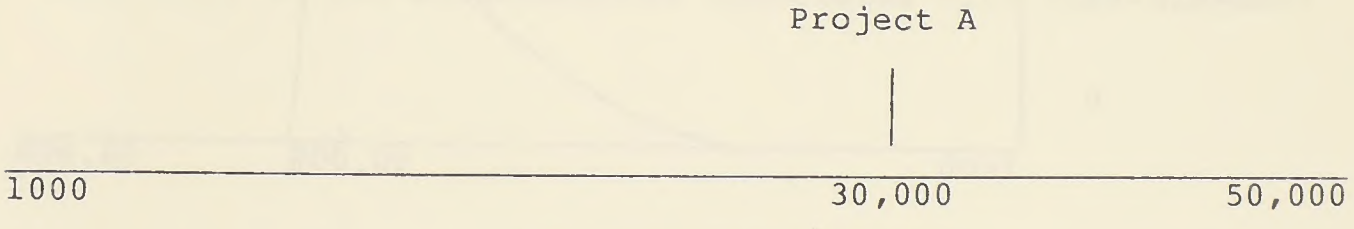


Figure E-1. Predicted performance of Project A

In figure E-2, a probability distribution has been drawn over the performance scale. The height of the curve represents the likelihood that each level of performance will be the true performance achieved when the project is implemented. The most likely outcome is the predicted performance, but higher and lower levels of performance are possible. Figure 5 represents a case in which there is only a small probability that Project A's performance will deviate significantly from the predicted 30,000 tons/year. This is shown by the relatively narrow probability distribution around the predicted level of performance.

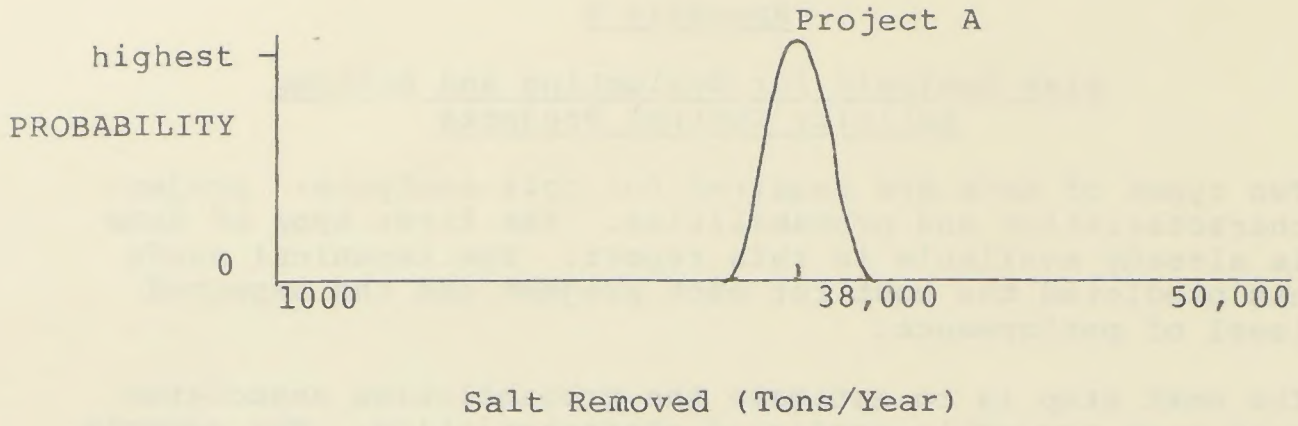


Figure E-2. Probability distribution over a range of performance--low risk case.

In figure E-3, much more uncertainty exists about the actual performance of Project A. Even though the best prediction of performance is quite favorable (40,000 tons), substantial risk exists that, when implemented, the project's performance may be much lower. Notice that, in this case, there is little likelihood that the project will remove more tons of salt than predicted.

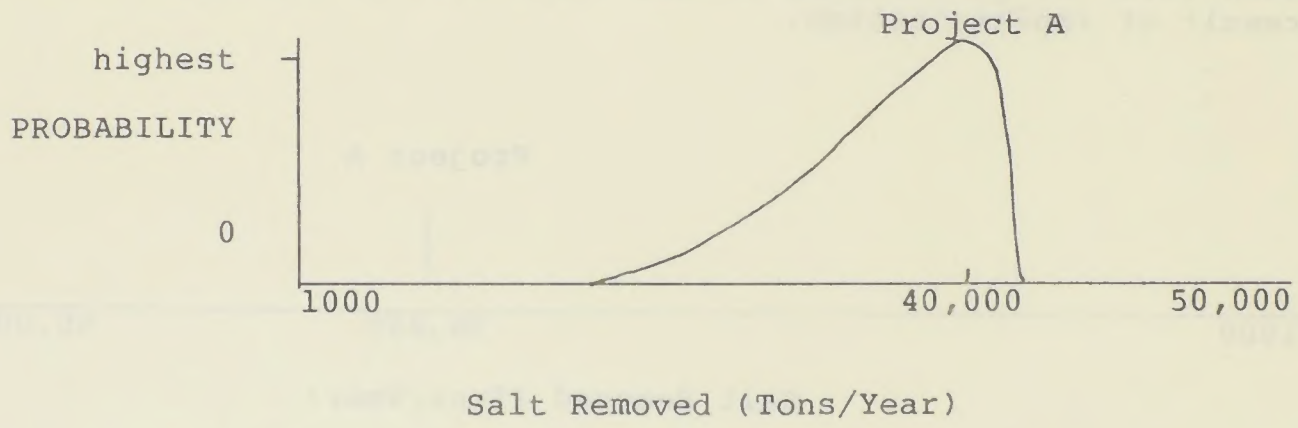


Figure E-3. Probability distribution over a range of performance--high risk case.

Probability distributions like those shown in figures E-2 and E-3 can also be estimated for the costs of each project.

Other risk factors do not require estimating probability distributions, only individual probabilities. For example, a significant risk question is whether a project is politically, fiscally, or socially viable--whether it could be authorized, funded, and constructed. Even the most efficient projects should not receive high priority if they cannot be implemented. One way to describe this risk is to

have Federal/State experts estimate the probability that a specific project could be implemented, given the project's characteristics and the social, political, and fiscal climate. Thus, each project would have both an expected cost effectiveness, if implemented, and an estimate of the likelihood of implementation. These would be combined to determine the project's overall composite project ranking.

Other risk factors can be included in the evaluation in similar fashion.

Study Concept

The main task of the study is to use the judgment of Federal/State experts involved in the salinity program and water resources development in the affected states to estimate the risks associated with each project. The panel of experts will specify the risk factors to be considered, e.g., project costs, project performance, implementability, etc. Data on these project characteristics will be provided by the technical staff. Experts will then estimate the probabilities associated with each characteristic, as described above. The project data and the probabilities will be combined in an expected value analysis. The projects will assigned a composite project ranking or a similar overall measure as specified by the panel. The overall ranking will be examined for clear breaks or clusters of projects that provide good performance and reasonable risks. Sensitivity analysis will be conducted to determine which risks contribute most to the uncertainties associated with each project.

APPENDIX F

BASIN FUND REPAYMENT OBLIGATIONS FOR USDA FEDERAL COST-SHARE FUNDS

(Hodel and Block letters)

1. Average life of the measures installed.

2. The interest rate for the current fiscal year (to be provided by the Department of Treasury through Reclamation).

3. The fiscal year in which measures become operational.

4. The annual repayment amount obtained by amortizing the Upper Colorado River Basin Fund share over the life of the measures.

D. Refunds (from non-Federal participants) received during one fiscal year will be accounted for by deducting the total from the current year's Federal funds reported. The amount of refunds received should be included in the annual report.

E. Statement by ASCS that the amounts to be repaid in B & C above are appropriate cost-sharing amounts for providing salinity control measures as authorized in Public Law 98-569.

F. The annual report should project the cost-sharing funding required from the Basin accounts for the upcoming fiscal years. The amounts are needed to provide the Bureau of Reclamation with the necessary information to work with the Western Area Power Administration on power rate increases so the Upper Colorado River Basin Fund will have funds for repayment of its share of the salinity control program.

We look forward to an effective and well coordinated salinity control program in the Colorado River Basin.

Sincerely,

Donald Paul Hodel

DONALD PAUL HODEL

Enclosure

Analysis of Department of Agriculture
Salinity Control Program Activities in Relation to
Cost Sharing from the Basin Funds

The Department of Agriculture has been developing regulations to carry out their portion of the Colorado River Salinity Control Program as authorized by Public Law 98-569.

During the review of the proposed regulations a question was raised as to which activities of the Department of Agriculture effort were to be repaid out of the Upper Colorado River Basin Fund and the Lower Colorado River Basin Development Fund. In implementing the new legislation, the Secretary of Agriculture may establish a voluntary cooperative salinity control program with landowners to improve on-farm management, improve related laterals, and reduce erosion.

The program consists of the following activities:

1. Identify salt-source areas.

2. Develop implementation plans.

3. Provide technical assistance in the design of measures to improve on-farm irrigation water management, related laterals, and erosion management practices.

4. Provide cost-sharing assistance for the voluntary implementation of plans through contracts and agreements with individual or groups of owners and operators of farms, ranches, and other lands, as well as with local governmental and non-governmental entities, such as irrigation districts and canal companies. Participants provide minimum of 30 percent cost sharing to this activity.

5. Provide continuing technical assistance for irrigation water management as well as monitoring and evaluation of changes in salt contributions to the Colorado River to determine program effectiveness.

6. Carry out related research, demonstration, and education activities.

In reviewing the legislation, one notes that Section 205(a) excludes costs borne by non-Federal participants pursuant to Section 202(c)(2)(C) of the on-farm measures from the allocation process.

Section 205(a)(1) recognizes that 70 per centum of the total cost of implementation of the on-farm measures are nonreimbursable, with the remaining costs reimbursable out of the Upper Colorado River Basin Fund and the Lower Colorado River Basin Development Fund. Section 205(a)(4)(i) provides that costs of implementation of the on-farm measures, including cost of construction of measures to replace incidental fish and wildlife values foregone, when such measures are a part of the on-farm measures authorized by Section 202(c), will be repaid from the two basin funds.

Section 205(b)(1)(2), as well as 205(c), (d), and (e), all utilize the term on-farm measures to describe that portion of the Department of Agriculture program that is to be cost shared from the basin funds.

In reviewing the legislative history, especially the House of Representatives Report 98-1018 which accompanied H. R. 2790, the activities to be cost shared are clarified on page 9. "Section 4(a) would revise the cost sharing set forth in Section 205(a) of the Act by adding cost sharing from the basin funds for the cost of on-farm measures, as well as measures to replace incidental fish and wildlife values foregone. It also provides that the cost sharing will occur after irrigators have provided up-front cost sharing for improvements on their farm." "Section 4(b) amends Section 205(a)(1) of the Act to provide that 75 percent of the total costs of Interior's construction, operation, and maintenance measures to replace incidental fish and wildlife values foregone would be Federal costs, and the remaining 25 percent will be paid from the basin funds. After exclusion of local, on-farm cost sharing, 25 percent of the balance of on-farm measures costs would be paid from the basin fund with the remainder repaid by the Federal government."

It is clear from the above two sections in House Report 98-1018 that the only activity listed for the Secretary of Agriculture to carry out that would be cost shared out of the basin funds was the cost-sharing assistance for on-farm measures, which the participants are also required to cost share. The main difference between H.R. 98-1018 discussion and what actually was authorized in Public Law 98-569 was that the cost sharing ratio was changed to 70 percent - 30 percent, instead of 75 percent - 25 percent, as discussed in the H.R. 98-1018. The change to 70 percent - 30 percent was accomplished by Metzenbaum Amendment No. 7071, and it is clear that Senator Metzenbaum understands the cost-sharing relationship, as he stated in the October 5, 1984 Congressional Record S. 13337, "The second Amendment requires the Secretary of Agriculture to recover a minimum of 30 percent from farmers participating in the on-farm salinity control program. This farmer contribution is in addition to the 30 percent State share."

It is therefore concluded that the Secretary of Agriculture will need to report annually to the Secretary of Interior the amount of Federal funds expended for construction and installation of on-farm salinity control measures. The other activities outlined in the legislation - such as identifying salt source areas, technical assistance in developing and implementing plans, technical assistance for irrigation management; as well as monitoring, research, demonstration and education activities - are all Federal costs that are part of the Secretary of Agriculture's Colorado River salinity control annual budget that is nonreimbursable.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

July 30 1986

Honorable Donald Paul Hodel
Secretary
Department of the Interior
Washington, D.C. 20240

Dear Mr. Secretary:

This letter is in response to your June 19, 1985 letter regarding Public Law 98-569 and the Department of Agriculture (USDA) onfarm Colorado River Salinity Control (CRSC) program. We concur in the procedures for determining and assessing basin fund repayment obligations for federal cost-share funds that will be expended under the CRSC program when it is implemented. Obligations to be reported are cost sharing for construction and installation of onfarm salinity measures, off-farm canal and laterals, and measures to replace incidental fish and wildlife values foregone.

We agree with the provisions for an annual report of cost shares expended to the Commissioner of Reclamation. This report will be provided by the Agricultural Stabilization and Conservation Service.

For purposes of accounting and repayment provisions, the average life of salinity control measures will be 25 years, unless determined otherwise on a project-by-project basis. We understand and agree that interest rates should be determined by the Department of the Treasury. All facilities shall be considered functional and operable the year cost-share payments are made, unless noted otherwise. Consistent with average life of measures determination, annual reimbursement payments from the Upper Colorado River Basin Fund will be amortized over 25 years, unless determined otherwise on a project-by-project basis. The annual report will also include projected USDA cost-share funding requirements for each of the next 5 years.

When USDA program funds become available and are expended under authority of Public Law 98-569, we will submit the requested annual reports of cost shares expended. We believe these procedures will allow for an effective and well coordinated CRSC program. We in USDA look forward to the continued cooperation and close coordination with the Department of the Interior.

Sincerely,

John R. Block
Secretary